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Pickling Practice and Theory

How to get best results
How to save materials

By W. H. Shipman
Associate Editor, American Machinist

WHY are forgings and castings often pickled before being machined in manufacturer's tests? Obviously because the manufacturer knows that the removal of scale and sand before machining will help the cutting tools to stand up better with less power consumption—at the guaranteed rate of production. Other common reasons for pickling in the metal-working and machinery field are for inspection and for the removal of scale and sand previous to plating, japanning, enameling, or galvanizing.

Since the pickling acids have little or no effect on oil, grease, and lubricating compounds, these substances must be removed by cleaning in the usual hot bath before the work is pickled. Proper cleaning of the work preparatory to pickling is said to save as high as half of the acid otherwise used. Sulphuric acid is by far the most commonly used acid for pickling iron, steel and brass. It is bought as commercial 60 deg. Baumé sulphuric acid, contains about 95.5 per cent of pure acid, and is used in strengths varying from 3 to 15 per cent of commercial acid, the remainder of the bath being water. Since the activity of any pickling bath increases with increasing temperature, it is common practice to heat the bath with steam. Sulphuric acid baths for iron and steel are maintained at temperatures from 120 to 200 deg. F. For brasses low in copper the bath is used cold, and for brasses containing 80 per cent and more of copper, the temperature is kept between room temperature and 150 deg. Fahrenheit.

The above temperatures are intended to give an idea as to average practice, and do not mean that everything inside these limits represents economical working conditions at all times. The strength and temperature of the bath depends to some extent upon the capacity of the equipment in the pickling department compared with the amount of work to be handled, as the smaller the capacity, the harder the equipment must be worked. Limits, of course, are set by the fumes, which increase with bath temperature and acid strength, and by the type of equipment and supervision provided. Automatic or semi-automatic equipment, and attention to ventilation, make it possible to increase greatly the output from a given floor space, and give the most uniform results with a minimum of supervision and labor. The best temperature, in general, is the highest that fume and fog conditions in the pickling room will permit; the best acid strength is the lowest that will get the work out in the desired length of time; and the best time is the shortest possible, never exceeding 20 min. The time on production pickling is often set by the time to load and unload work-carrying racks. The test results of Figs. 1, 2 and 3, which were published in

Pickling is a neglected operation in many plants. Neither management nor workmen would tolerate in other departments the type of conditions often found in pickling rooms—obsolete equipment, an atmosphere laden with fumes and steam, leaky tanks, and sloppy floors are common; and often little attention is given to economical production. The data given will aid sound self-analysis prior to modernization

The first part of the article. The conclusion will appear in an early issue.

The Enamelist, are interesting in this connection. The tests were made on thin, annealed sheet steel pickled in a fresh bath, and must not be taken as applying directly to practical pickling operations where the acid contains considerable iron. However, they show very clearly *why* the bath is run warm, and approximately what the acid strength should be. In connection with the following test results, which show the effect of increasing contamination of the bath by iron salts, the curves of Fig. 1 are good starting points for tests with work in process. All three of the following tests, which are ascribed to Bablik, were made with a 5 per cent solution of sulphuric acid:

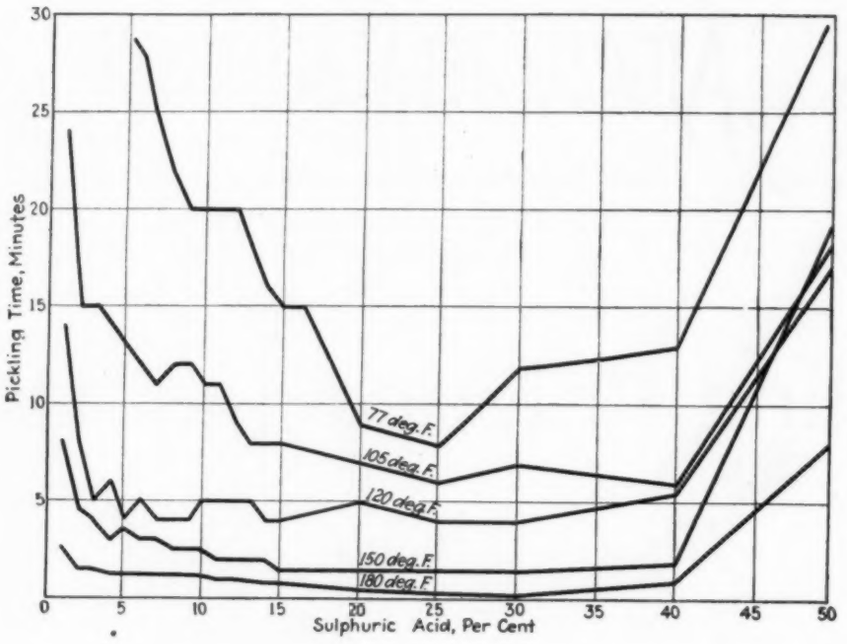


Fig. 1—Results of tests by J. T. Robson, Ph.D., on twenty-gage sheet steel which had been given a light anneal. The tests were made with a rather fresh bath and are useful in showing the relative and not the exact influence of the factors of acid strength and temperature on pickling time

Iron Sulphate Per Cent	Pickling Time in Per Cent
5	100
10	160
20	230

Ten per cent of iron sulphate slowed up the action of the bath in this test until 60 per cent more time was required than when the sulphate content was 5 per cent.

In other words, the best results are obtained when the strength, temperature, and time of the pickling operation are studied just as feeds and speeds are in the shop—on the job with the work that is being handled.

The speed of pickling is increased by agitation and aëration of the bath, and this is accomplished by various means such as lifting the parts out of the bath frequently. Continuous aëration and agitation by machine is said to cut the acid consumption and time required to as low as 50 per cent of the figure required by hand. Part of the effect can be obtained by agitation of the bath by means of a piston and cylinder at the side of the tank.

Muriatic acid, which is commercial hydrochloric acid, is sometimes used for iron and steel. It is purchased as 18 deg. Baumé muriatic acid, contains 31.5 per cent of pure acid, and is used in strengths varying from 3 to 15 per cent of commercial acid, the remainder of the bath being water. For equal percentages of pure acid, muriatic acid is much stronger than sulphuric, acts quicker, and is harder on the equipment and on the workman. The bath temperature varies from 70 to 150 deg. F. in practice. The curves of Figs. 2 and 3 show the general effect of acid strength and temperature on solutions of muriatic, and on solutions consisting of a mixture of sulphuric and muriatic acids. A comparison of the curves of Figs. 1, 2 and 3 shows, in a general way, the relative activity of the three solutions.

Sulphuric acid is more widely used than muriatic, because of its lower cost. The muriatic costs more than twice as much for the same acid action when the two acids sell for the same amount in carboys, and the muriatic is more expensive at the present time than indicated by this comparison.

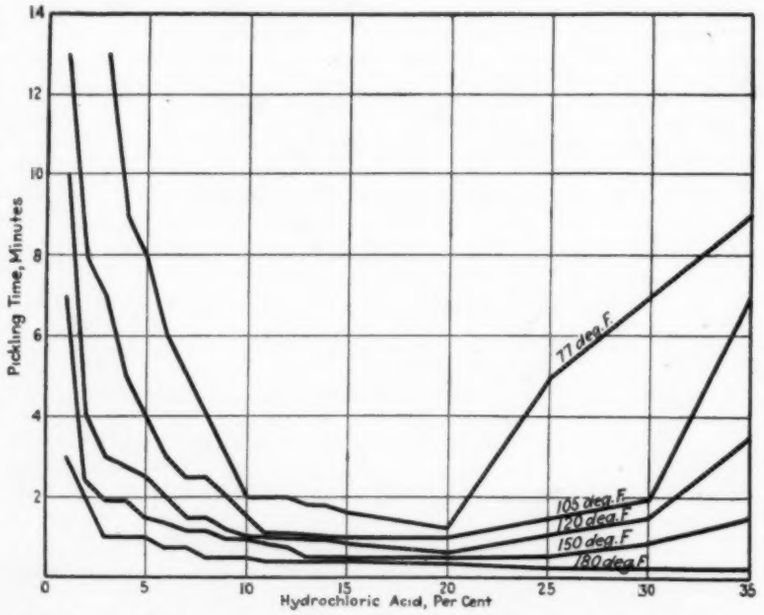


Fig. 2—Influence of acid strength and temperature on time of pickling with a hydrochloric acid bath

It is claimed that part of the increased speed obtained from a mixture of the two acids may be obtained at a lower cost by the addition of common salt to the ordinary sulphuric acid bath. The salt reacts with the sulphuric acid to form hydrochloric acid and sodium sulphate. Niter cake and other industrial by-products under various trade names have also been used, but care should be taken

in purchasing and inspection that the product obtained is as economical as the straight acid replaced. Since niter cake in solution averages about 35 per cent sulphuric acid, the remaining 65 per cent being sodium sulphate which slows down the action of the acid, the price paid per unit of actual acid should be less than that for sulphuric acid. Other products can be compared with sulphuric acid in a similar manner.

In pickling brass, a more uniformly bright yellow is obtained with greater freedom from red copper streaks if a solution of 5 per cent sodium bichromate and 5 per cent commercial sulphuric acid is substituted for the sulphuric bath. The solution is used cold. A dip in cream of tarter followed by rinsing, results in a still brighter finish for the brass.

For pickling and brightening copper, brass, and bronze, a mixture of sulphuric and nitric acid is used. The operation is called "bright dip" rather than pickling. The fumes are very offensive to workmen, and must be taken care of by the ventilation system. Nitric acid is sold as 38, 40, 42 and 43 deg. Baumé nitric acid.

Aluminum forgings are sometimes given a light pickle in a caustic soda solution to remove surface oxide, and to show up possible defects in the forging. A 10 to 20 per cent solution of commercial caustic soda is used, and provision is made for warming the solution. Sheet metal aluminum articles are sometimes pickled in a 5 to 10 per cent caustic solution to give a "matte" surface.

Hydrofluoric Acid for Sand Removal

For removing sand from castings to make for easier machining, or to prepare for plating, enameling, japanning, or galvanizing, a pickle in hydrofluoric acid is coming into quite wide use. Since the hydrofluoric acid attacks only the sand and not the scale, a pickle in the usual sulphuric acid bath sometimes follows, or a sand-blasting or tumbling operation often precedes. The claim is made that the hydrofluoric pickle leaves the metal surface in a soft condition, whereas the impact of the other methods produces a hardened layer which is somewhat harder on cutting tools than the pickled surface. Other firms use a mixture of about equal parts of hydrofluoric and muriatic acids, so that scale and sand are attacked simultaneously.

The hydrofluoric acid pickle is also useful as an inspection measure, as it shows up sand holes. The combination of hydrofluoric pickle and hydrostatic tests is considered good insurance by some companies making and buying castings for high pressure, hydraulic, steam and gas service. From 5 to 50 per cent commercial hydrofluoric acid is the range of strength used, and provision is often made for warming the bath. The operator must be equipped with rubber gloves, boots and aprons, and provision must be made for carrying away the fumes. Hydrofluoric acid is shipped in lead carboys, or composition containers, because the acid attacks glass.

Inhibitors are substances added to the pickling bath to control the attack on the iron and the evolution of hydrogen. They have the property of localizing the action of the acid to the scale, and of protecting the iron. If iron and steel are pickled without inhibitors, most of the scale comes off quickly and the metal is exposed to attack while the acid is removing the rest of the scale. Inhibitors form a coating on the clean metal, thus protecting it from the acid. A thin coating is also formed on the scale and rust, but the net effect is that the pickling can be speeded up with less loss of metal and acid, and with better working conditions for the operator. If too much inhibitor is used, the speed will be cut down due to the increased layer of inhibitor over the scale.

Some of these inhibitors are sold under trade names, and sometimes such substances as molasses, flour, sizing, bran, sugar, cornstarch, and certain coal-tar derivatives are used. Most inhibitors are readily soluble in the bath, and are added by mixing in a pail with some of the pickling bath and filtered, or are suspended in a bag in a corner of the tank.

Inhibitors also give such control over the pickling of high-carbon and alloy steels that, it is claimed, these steels may be pickled at the same time, and under the same conditions as low-carbon steel parts. The use of an

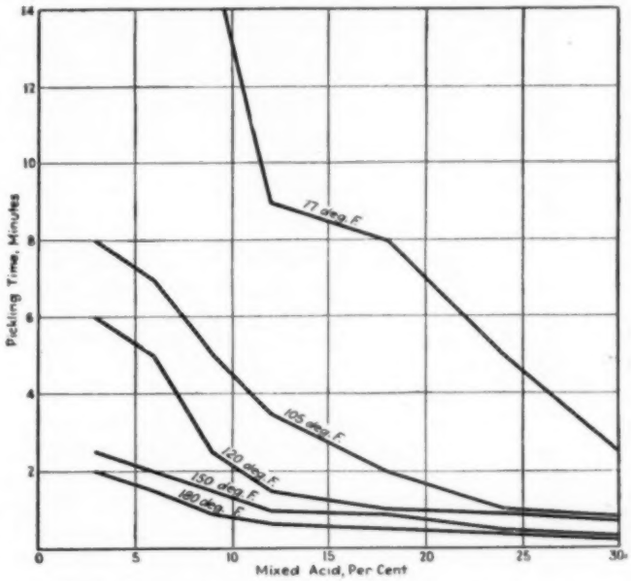


Fig. 3—Influence of acid strength and temperature on time of pickling with a mixed acid bath consisting of two parts of sulphuric acid to one part of hydrochloric acid

inhibitor is to be recommended for most installations. Another type of compound forms a coat on the surface of the bath, and breaks up the gas bubbles rising to the surface so that the fumes and loss of acid are still further reduced. Other compounds perform both functions, and still others are contained directly in pickling baths sold under trade names.

The action of pickling acids on brass is such that the metal is not attacked, there is little hydrogen evolution, and inhibitors are not necessary.

Parts subjected to shock in service should be heated in boiling water in an open tank for several hours after pickling, to remove hydrogen brittleness—brittleness caused by part of the hydrogen given off going into the metal. The boiling water also serves to clean the acid, iron salts, and inhibitor from the work. Tests have indicated that weak acid, combined with high temperature and long pickling time, are factors making for hydrogen brittleness, and should, therefore, be avoided. Inhibitors have a marked effect in reducing hydrogen brittleness, because the attack on the metal and evolution of hydrogen are decreased.

Pickling can, and should, be studied as an operation and reduced to a standardized production basis. When pickling operations receive the sort of close study now given to machining operations, pickling conditions, equipment, and costs will go through the same course of modernization as have these other operations.

Getting Men from Other Industries

BILL HOLLAND was closeted with John Berger, of the Excelsior Press Company, and Frank Williams, a retired foundry man who was one of the Press company's directors. Things hadn't been going any too well, and they were discussing the selection of a new shop superintendent, but were not in agreement as to the method to be used.

"Williams tells me the only thing to do is to find a good man from another shop that builds presses," began Berger. "I have a notion we may get on better if we find a man from some other line."

"How can he expect a man who builds ice cream freezers to know much about presses, Holland? We want a man who knows presses from A to Z—but he wants to be a young man with lots of push, and not too much money, so he'll work hard to get ahead," said Williams.

Holland laughed. "You want a man with a college education, fifteen years of shop experience, and good judgment, who ought not to be over thirty, I suppose. I've known a lot of cases like that. Let's hear what Berger has to say for *his* plan."

"It's been my experience, Holland, that most men who stay in one line know very little about how other kinds of machines are built. My notion is to get a man who has been in a line where work moves through the shop fast, or regularly at least. Say a man from a small automobile shop.

"Of course I know our production won't be large compared with the auto shop. We can't even have line production on the whole machine. But he ought to know how to keep work moving. He at least knows what things clog production, and that in itself is a big factor. He ought to know some of the secrets of speed, and how to avoid a lot of the lost motion that exists in the average shop."

"I don't believe it will work out John," broke in Williams. "Making automobiles and presses are two entirely different propositions. A man of that kind will run you into all kinds of trouble. He'll want conveyors and special machines that we can't afford in our line of work. Don't you agree with me, Mr. Holland?"

"Not entirely, Williams," replied Bill. "There's quite a lot in what Berger says about getting men from other industries. We are all too prone to stay in ruts, and are not well enough acquainted with what is being done in other lines of work. I've known cases where Berger's plan has worked out well, and some where it didn't. It depends almost entirely on the man you pick."

"Isn't a man from a small shop better for us than one from a big plant? Wouldn't a man from the big plant be likely to have big ideas?"

"Depends on the man, Berger. I know one case where a man from Ford's made good in a small shop where he couldn't use any 'progressive' methods. But he brought along a lot of good ideas, used them where they fitted in, and made money for the small firm. *He* had a lot of horse sense.

"I knew *another* man who couldn't adapt himself to the new conditions. He was used to spending money freely for any equipment he felt he needed, and he couldn't seem to realize the difference in conditions. The manager had to watch his requisitions like a hawk to prevent buying more than they could pay for."

"Then you think my plan has its possibilities, Holland."

"The plan is O.K., if you can get the right man. If you don't, Williams will be able to say 'I told you so.' Pick your man right, and I don't believe you'll be sorry. But it's no easy job to pick the right man."

"And don't forget what Holland said about watching requisitions for new machinery and equipment, Berger. If you don't the new man may get us into a hole," said Williams as a parting shot.

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

EXECUTIVE FORUM

Discussion

Idle Machines and Net Profits

If Mr. Roberts can lower costs for the Watkins Machine Company by the installation of new machinery, pay for it, and show a profit for the fiscal year, idle machine time is of no importance. Profit per machine per year is all that the ledger need show. If the cost can be reduced it may be possible to obtain more work.

Since idle time is the subject under discussion, let us turn to one of our greatest industries, farming. A farmer uses his plow about one month each year; his planter about two weeks, and his cultivator about one month, and so on. If idle time is the important factor, why not have the farmer spade up his fields, drop the seed by hand, and hoe the weeds out?

If we are to consider the profit side of the ledger, idle time means no more to machinery investment than it does to the lighting fixtures that are idle all day, or the heating system that is not used all summer. —W. E. FISCHER.

The question of whether to purchase new equipment, or not, should not be influenced by personal opinion which desires to have the latest in everything as a matter of pride nor by a personal preference for deferring replacement unless the equipment can be utilized to full capacity. If the new equipment, on the current volume of work, can show a profit on the capitalized investment sufficiently in excess of that now prevailing on present equipment, it should go in. If it does not, its purchase should be deferred until an increase of volume warrants a recheck.

—RUSSELL T. WALKER.

Finish on Machines

It's surprising how the question of the value of finish on machines persists, in spite of the overwhelming evidence in favor of it. For example, did you ever attend a show or exhibit of products in any field, where the show models were not finished to the last degree? Even if the product is sold normally without any finish, the show models are always oiled and polished. This seems to establish conclusively the value of finish in promoting sales.

Machines are sold not only on their ability to perform a given operation under demonstration, but also to keep on doing it for years in the average shop under average conditions and care. The ability to "carry on" is a function of the design and materials of the machine itself, the instruction of the operator and the care taken of the machine. The last point is the one solely beyond the control of the builder, except insofar as he can win appreciation for his machine. For the good finish alone does in this respect, it is well worth the cost.

With the value of finish conceded, there is but one point remaining. What kind of finish? The best is advisable in every case. Labor costs in applying a finish represent a large part of the total cost, therefore there is no economy in cheap materials. Only the best should be used, because if the finish begins to break up prematurely, suspicion is cast on the entire machine.

—A. G. SCOTT.

Archaic Accounting

With a good system of general accounting, the manufacturer can ascertain at the close of each fiscal period the amount of his total profit or loss. If the books show a profit, he may be satisfied, even though it is small. If, however, a loss has been suffered, the books may not be in such detail as to enable him to ascertain the cause or the way to prevent future losses. Unless prices in the trade are rising, the remedy of increasing his selling price is not open to him, as he must meet the competition of fellow manufacturers.

In order to determine whether or not he can continue to manufacture his various articles profitably, he must have a system, modern and efficient, to show the costs and profits on his different products. A general accounting system will not do this; a cost system will. With a good cost system the manufacturer can concentrate his efforts on manufacturing and selling the more profitable lines, and at the same time be able to reduce his costs through the knowledge given by the detailed figures.

Ideal cost systems cannot be installed readily in all firms. The difficulties in installation may be owing to numerous technical operations, or merely to opposition on the part of the management and workers. Nevertheless, while this oppostion may be discouraging, it should not prevent installation of practical features which would improve the existing system.

One of the most important advantages of a good cost system is that it shows accurate unit and total costs. Progressive manufacturers want to know the cost of their individual units of product. Total costs alone do not satisfy, neither do average costs for the business as a whole. With exact costs, profitable and non-profitable lines are clearly recognized.

It is no longer safe to operate a business

by simply adding to prime cost an arbitrary percentage deemed sufficient to cover both factory burden and selling and administrative expenses, and then to trust that the selling price will be high enough to cover all costs and to allow the desired margin of profit.

—HARRY KAUFMAN, *Public Accountant.*

Paying for Advice

The logic of Tom Hudson's position is indisputable. But there are more things than logic in life; and many of these things have to be reckoned with seriously. This constitutes the strength of Bert Winter's "wait-and-see" attitude.

For success to be assurred probably requires that this "about-face" shall be more than a one-man affair. If Mr. Hudson can convert a sufficient number of fellow proprietors to his way of thinking, then he has a reasonable chance of gaining his point.

In his own interest, it is questionable, to say the least, whether Tom should adopt such strategy. He would probably do far better for himself if he were to make clear that a nominal charge would be made for advice, should such advice not lead to an order.

On any count, whether he proceeds with his idea or not, the next time the architect "drops in about his car and the pumping plant" Tom will know where to place his blank for a retaining fee.

—W. R. NEEDHAM, *England.*

Should a Buyer Specify Design or Results?

Whether a buyer should specify design or results depends largely upon the buyer's familiarity with the machine in question, and his knowledge of the character of the work it is to perform. A well drawn contract of sale contains in writing all the essential requirements to be met, together with any peculiar conditions that must also be considered. Every order, however, presents its own problems as to what these requirements are, and this can best be illustrated by the following simple cases.

In the first case: A buyer has a machine which is very satisfactory, and he wishes to duplicate it. His purchase order should naturally specify a machine of the same design as his present one.

As a second case: A buyer wishes to purchase a unit heater to heat his factory. He knows nothing of the design of unit heaters. His order should, therefore, specify the results, namely, that it must keep a room of certain dimensions at a certain temperature, together with the peculiar conditions to be met, such as pressure of steam available, and kind of electric current at hand.

In a third case: A buyer wishes to purchase some bulk material-handling equipment for handling a material which he knows to be very abrasive. His order should specify a machine to give the required results, namely, handle so many tons per hour, and, in regard to design, should also specify that certain wearing parts be made of a wear-resisting material.

From these simple cases it can be seen that when buying equipment a buyer should not only rely upon the knowledge of a reputable manufacturer to furnish the best design to give the required results, but should also make use of his own knowledge as to certain phases of design.

—W. S. ELLS.

Overhead and Profits

Overhead will certainly eat up profits unless it is included in the sales price, and it will just as certainly eat up the whole establishment if sales are not made. Therefore, the idea of using replacement value instead of original cost as a basis for depreciation seems to be dangerous, for such a practice may raise sales prices until sales become difficult to make and the volume falls off. Moreover, replacement values cannot be determined accurately, since prices change.

A safer method would be to stick to the orthodox depreciation on original cost and add a factor for replacement reserve. In cases of close competition part, or all, of this reserve may be knocked off without taking an actual loss.

If such a factor as a replacement reserve is used in the costs, it should also be set up in the general books where it will appear as a liability. If the volume of sales is good this liability may be offset by an asset consisting of bonds or other good investments. Although a replacement reserve does not appear as such in the financial statements of our large corporations, there is always a large item for depreciation and one suspects that replacement has been given consideration.

—C. J. MORRISON.

The "Can't-Be-Done" Man

The business of the manager is to get things done, to lower costs and improve quality, to maintain or increase profitable operation. He must stand on the results of his ideas as carried out by his assistants and department heads. Much of the planning and practically all of the details must rest in their hands. Therefore, they must be men in sympathy with him and his ideas, able to think, and not hampered by out-of-date traditions. In making his appointments to these important positions, he should not be dominated by the big boss.

The men of experience who say it can't be done possess the false notion that theory and practice do not agree. They are in the rut of knowing so much that they can learn no more on their own volition. Their experience is a tremendous handicap on their ability that will hold them down until they discover that brains are given to men to think with.

—L. O. BROWN.

Welded Structures Aid Material Handling

By A. R. ALLARD
Works Department, Westinghouse Electric and Manufacturing Company

Ease of construction, low cost, and adaptability to changing conditions make welded structures well suited to special designs for material handling and storage

MANUFACTURING operations in recent years have received the most careful consideration and analysis, and have been aided by the development of highly effective special machinery and equipment. The intermediate steps of handling and storage between manufacturing operations have not always been favored with their warranted share of attention. This neglect has been due primarily to two reasons: First, to the almost universal practice of obscuring these operations and material costs by bulking them with other numerous items which go to make up expense or overhead percentages; second, to the lack of suitable and equally effective special equipment with which to perform the operations of handling and storage. All too frequently valuable manufacturing space is used for material handling or storage space when, if proper handling and storage facilities were provided, the space could be devoted to production uses. Equipment such as bins, racks and benches of special design are great aids to the effective handling and storage of materials. These can be made, with a little thought, to meet the exact requirements of any particular application. Very often they can be made to fit into places not available for other uses, but which are quite suitable for storage. Every application of this kind adds to the effective use of floor space. Another way of saving space is to design the apparatus so that the materials will fit the compartments exactly. This is one of the great advantages of special equipment over stock or standard designs. Another advantage of such equipment is that of having provided a definite set up for the performance of the activity. Haphazard storage means waste.

Fig. 1 — Greater storage capacity than existing standard equipment of same space requirements, and greater accessibility were obtained by arc welding this rack using structural shapes

In Fig. 1 we have an example of a special rack the capacity of which for the storage of motor frames is much greater than the corresponding floor space or that which can be obtained by the use of existing standard equipment. This is a good illustration of the effective use of floor space. The rack shown is made to the required dimensions and is fabricated from standard structural shapes joined together by the use of electric arc welding. It is obvious that the cost of such equipment is not prohibitive, and that the lack of it is costly.

Another example of equipment designed to economize floor space is shown by Fig. 2. It consists of a rack mounted on the steel skid of an elevating truck. The vertical standards are arc welded to the skid, and the wooden cross members are bolted to the uprights and can easily be renewed when worn or broken. The wood provides ample protection to the rotor shafts. In addition to using floor space economically, considerable economy is effected in the savings made in the use of labor for handling and transporting operations. The effective use of the labor employed in material handling and storage activities requires that considerable thought be expended in properly planning, systematizing and supervising the activities, and in the designing or securing of suitable equipment. Economy in the use of labor requires that the materials be moved from point to point in economical amounts, that the storage facilities provide concentration of stores without congestion, and that the labor expenditure for handling and conveying be effectively applied.

Probably the greatest example of economy in the use of labor by the employment of special equipment in material handling and storage activities is that brought into use for the dual purpose of handling and storage of materials or parts between process operations. This development is the result of quantity production. Considerable attention is being given to the development of

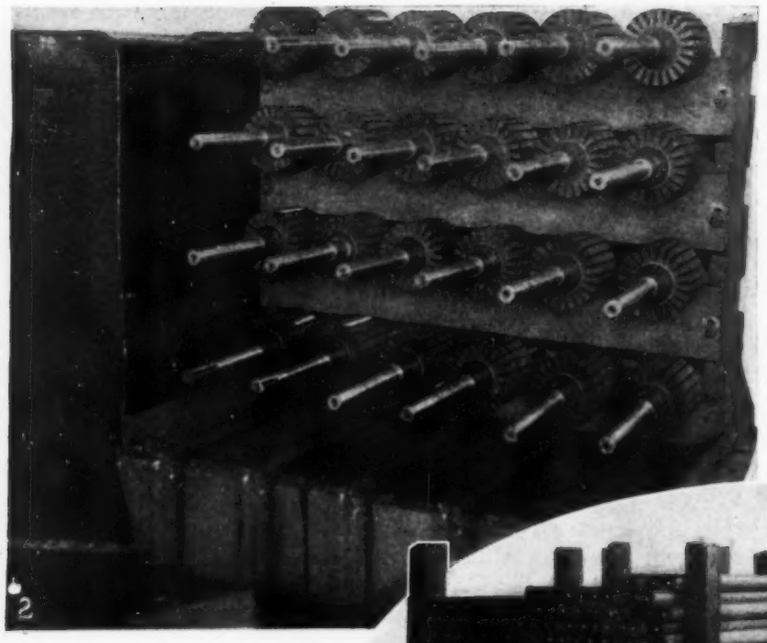


Fig. 2—A few members welded to a standard skid provide an extremely simple and effective structure for rotors and their projecting shafts. The skid base keeps other structures at a safe distance, and the wooden cross-members prevent marring of the shafts

Fig. 3—Standard structural shapes lend themselves to the placing of wooden protection posts and boards which reduce the care necessary in handling

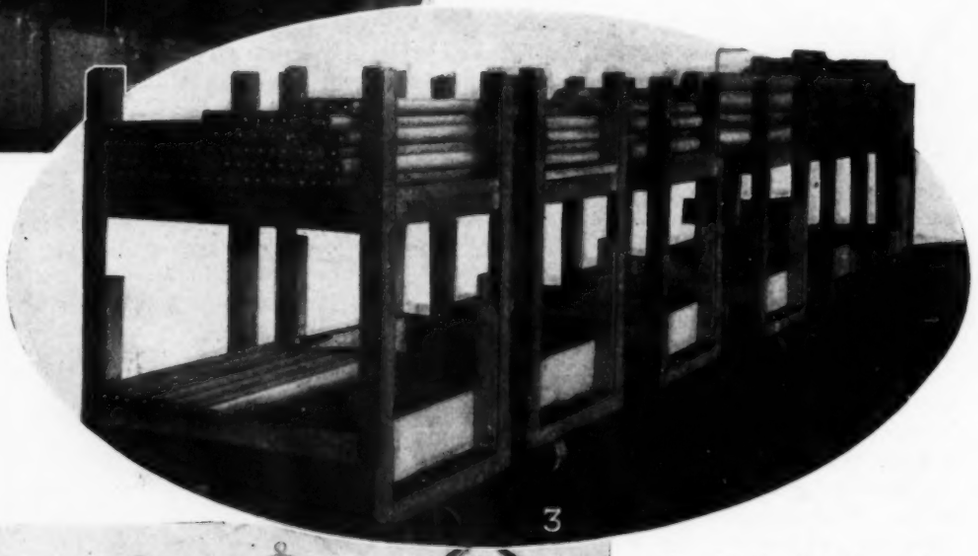


Fig. 4—Numerous trips to the storeroom are unnecessary when all the parts used to make up an assembled unit are placed on trucks such as these and taken to the job

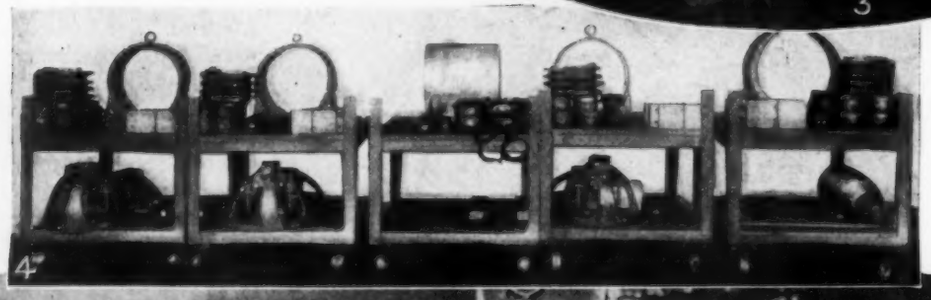


Fig. 5—Parallel lines of conveyors are connected by the section which travels on a cross track. Welding furnished a convenient means for building up a stiff and rugged structure for this unusually severe service

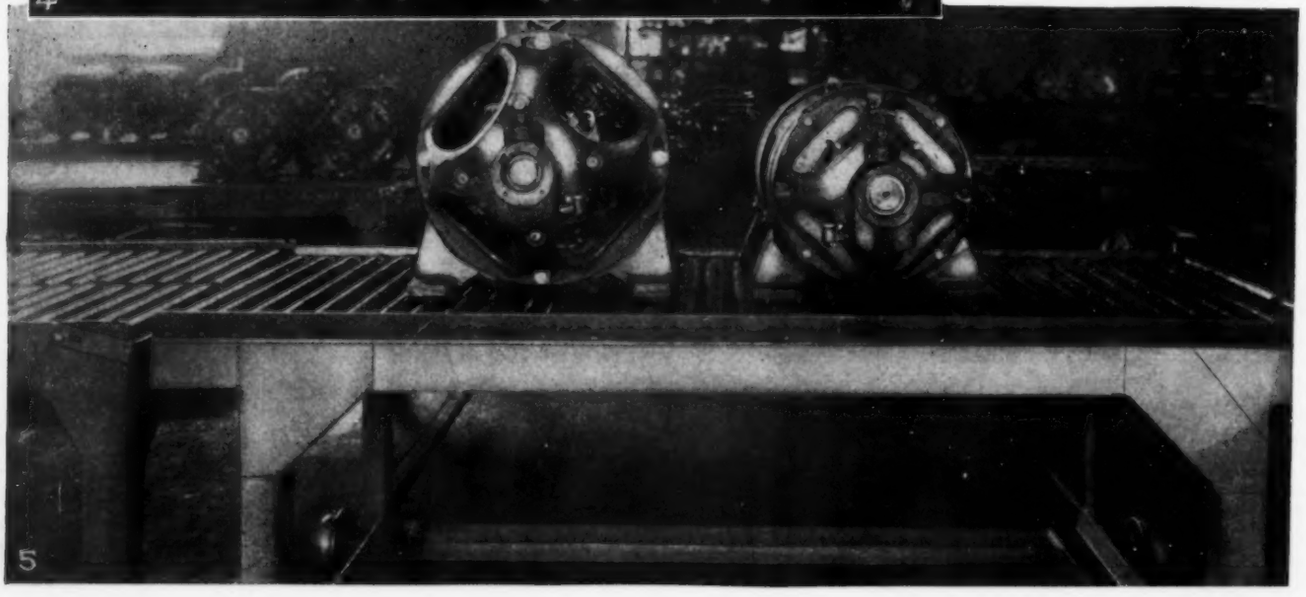


Fig. 6—Long sections of shafting and piping are difficult to handle. They do not shift position on this combined transporting and storing structure

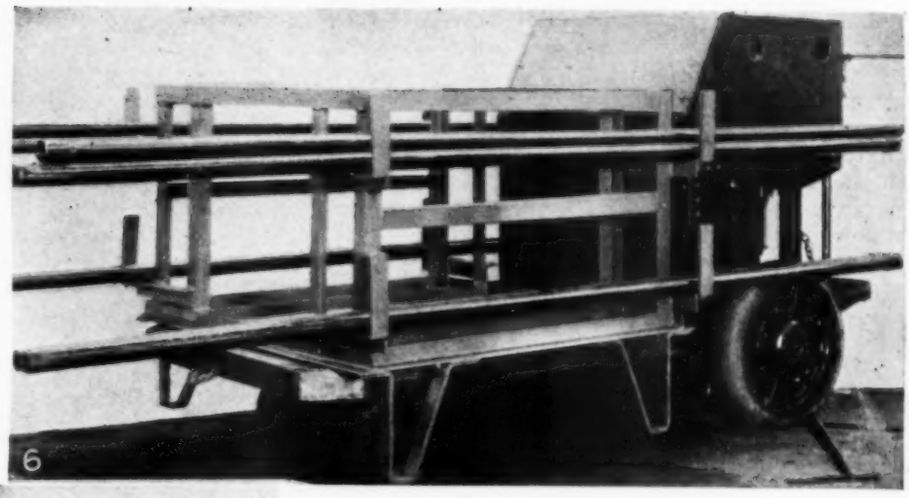


Fig. 7—Trays of fragile materials and small parts can be transported and stored in large quantities with little rehandling when trucks of this type are available. Compare welding such a truck with other means of fabrication

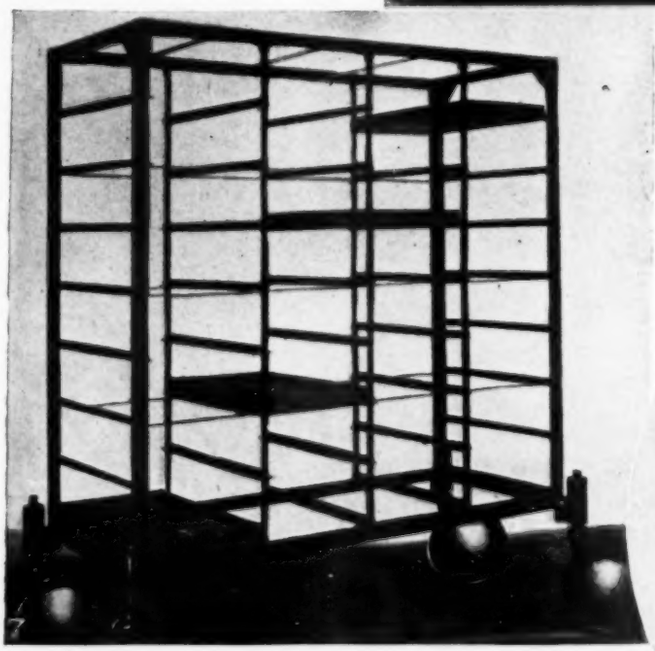


Fig. 8—The complete control given by the handle and reduction gear of this device for handling carboys of acid reduces the acid hazard in this plant

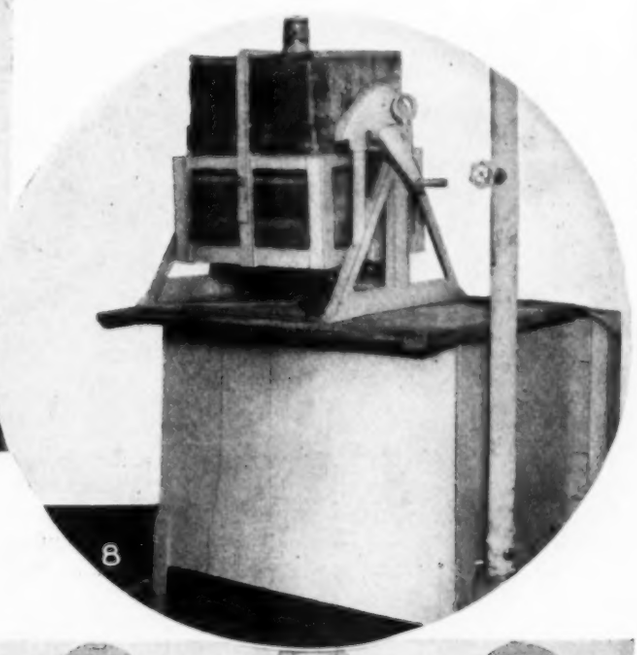
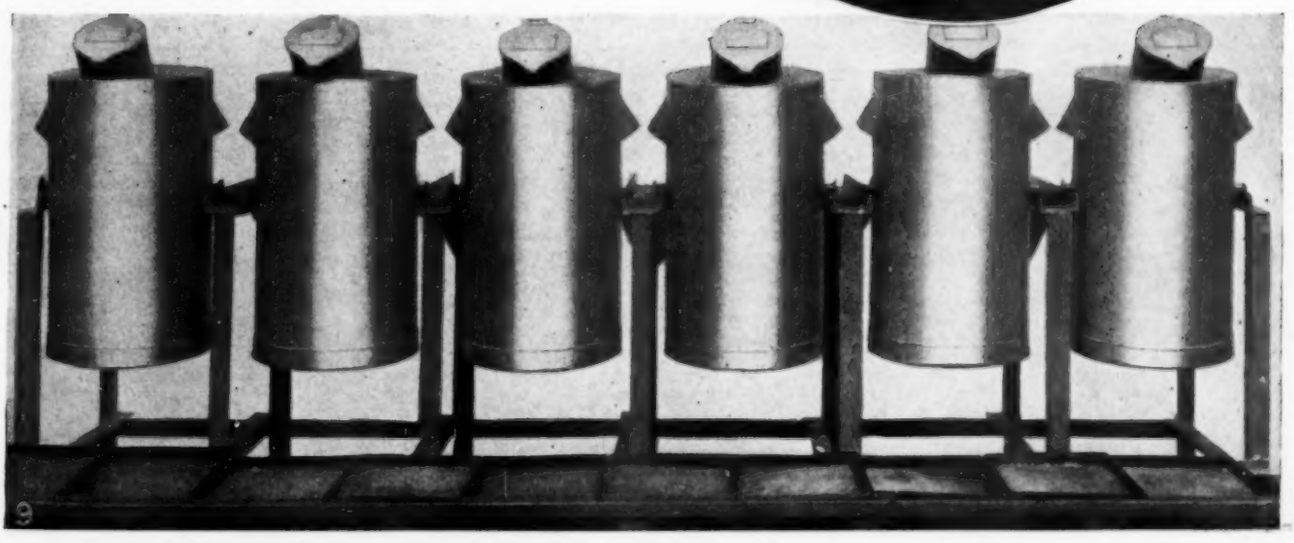


Fig. 9—Waste and unsightliness too often go with the dispensing of paints, varnishes and oils. The arc-welded equipment shown here is one way of bettering these conditions



special equipment for use in moving relatively small quantities of materials from operation to operation, as well as providing storage in such a manner as to eliminate unnecessary handling.

In Fig. 3 is shown a special arc-welded truck used for the transportation of shafts from operation to operation. The details of construction are easily seen in the illustration, as well as the absence of the usual gusset plates and braces so necessary in riveted construction.

Trucks of the type shown in Fig. 4 are used for the storage of the detail parts used to make up an assembled unit. When all items have been received and placed on the truck, the latter is moved from the storeroom to the assembly floor. In this way jobs cannot be placed in process until the needed materials are at hand, and considerable labor is saved by the elimination of numerous trips to the storeroom. The truck is also used as a work bench in the assembly department. After completion of the assembly operation, the truck carries the machine to the inspection floor, and from there to the test floor. Trucks of this type are particularly valuable where quantities and sizes vary greatly, and where assemblies differ sufficiently to make progressive layouts impracticable.

A variation of the extensively used roller conveyor is shown by Fig. 5. This particular truck is one used between parallel lines of similar conveyors to transfer machines or assemblies from one conveyor train to another. The truck operates on the cross track, and is subjected to excessive shock and relatively heavy stresses due to the break in the conveyor track which robs the short section of the rigidity and support that it would obtain if the members were one continuous train. Because of this severe service, and the need of great rigidity, arc welding was used as a means of joining the conveyor truck parts.

In Fig. 6 is shown a specially designed arc-welded rack to be used with a truck of the elevating type for the transportation of long sections of pipe and bar stock. The advantages of transporting this kind of material in this way extend far beyond the labor saving phase.

In Fig. 7 is illustrated a type of truck used in transporting fragile materials or small parts which can be handled on trays. The truck assembly is arc welded throughout, except where the castor brackets are bolted to the frame. The castors are of special design and support the load on compression springs. The wheels are equipped with rubber tires.

Not all money employed to finance material handling and storage operations is spent in providing floor space and paying labor. Considerable capital is invested in the equipment used, and in paying for damages due to carelessness and the use of inadequate equipment. Careful selection or designing of the apparatus is necessary if the greatest return per dollar invested or spent is to be effected. First cost considerations should not be the deciding factor in the selection of equipment, because of the fact that special equipment which fills the needs exactly can be built at low first cost.

Handling and storage equipment should afford protection to materials against breakage, leakage, and damage from any cause. Considerable expenditures of money are often made as a result of losses which could have been avoided had proper facilities been provided. In Figs. 8 and 9 are shown equipment which is used to dispense materials of various kinds in an economical manner. The first, Fig. 8, shows an arc-welded carrier used to handle carboys of acid. The basket is supported by a trunnion on either side, and can be tilted to the desired angle by turning the hand crank shown. A suitable gear reduction gives slow movement and easy control of the operation. Note the safety cleat which prevents the carboy case from slipping out of the basket when the elevation is great enough to favor a shifting of its position. Beneath the carrier is shown an arc welded rinsing tank provided with steam supply line. This tank is subjected to temperature extremes within short intervals of time.

In Fig. 9 is shown a rack with containers designed to handle materials such as paints, varnishes, or oils, in an exceptionally satisfactory and economical manner. Each container is plainly marked with the material name and number, thus avoiding the possibility of using the wrong material because of mistaken identity. Removable drip pans are provided for the purpose of preventing the usual smeary condition which accompanies the dispensing of materials such as varnishes in small quantities. In addition to other advantages, this scheme possesses that of being a preventative of fires where inflammable materials are handled. The containers and rack are welded.

The advantages of welded equipment for handling and storage of materials are numerous, among them being the ease with which effective apparatus can be built, low first cost, ease of alteration, indestructibility, low maintenance cost, light weight, and excellent appearance due to lack of gussets and braces, they are fireproof, and possess ease of cleaning, durability and rigidity.

Management in the *American Machinist*

A prominent consulting engineer in the management field remarked recently that he found much of solid, practical value on the management problems of the metal working industry in the editorial pages of the *American Machinist*. Which was encouraging because, in addition to articles on management, there are the two departments, The Executive Forum and The Foreman's Round Table, that are built entirely on problems that have actually arisen in specific shops. If such items are of value to a consultant they are of even greater worth to the man who has not the consultant's opportunities to see what is being done in many plants, and to draw comparisons between different ways of doing the same job.

Centralized Records for Efficient Tool Control

By N. J. Bowne and N. Holve
The De Laval Separator Company

Details of the system and some of the forms used in keeping the records

THE records in the tool control fall into the following three main sections: (1) Master tool-record, (2) cross index, (3) location and depreciation cards. The master tool-record, Fig. 4, is a combination of records giving a complete story of a tool from the moment it is placed on the designer's board until it becomes obsolete and is actually disposed of. This is accomplished by combining in one Kardex pocket all temporary records regarding the tool with the permanent master tool records. This record gives the following information: (1) Tool number, (2) drawing number, (3) pattern number, (4) material to be used, or name of vendor, (5) control of order number, (6) requisition number, (7) requisition date, (8) control of serial numbers, (9) estimate, (10) comparative cost, including time, (11) date order closed, (12) material actually used, (13) time for design, (14) time for pattern, (15) time for templet, (16) disposition in case of obsolescence, (17) yearly usage in department, (18) withdrawals from stores, (19) complete description, (20) operation used for, (21) part number used on, (22) machine tool used in, (23) product used for, (24) equipment requisition number, (25) equipment requisition date, (26) due date of order in process, (27) brief name, (28) main size, (29) progress of order in process, (30) location of master stock, (31) place for order points. With a balance card, Fig. 4, inserted in the pocket, the following information is added, but the most-important information on the master card is still visible: (1) Tool number, (2) order number, (3) brief description, (4) requisition number, (5) unit price, (6) card number, (7) balance on order, (8) balance on hand in storeroom, (9) balance on hand in department and maximum balance allowed, (10) withdrawal from stores of reclaimed tools, (11) withdrawal from stores of new tools, (12) current usage in each department.

When an order is issued to the toolroom, the tool-manufacturing order, Fig. 5, is filed in the back of the preceding pocket, and gives the following information: (1) Quantity ordered, (2) quantity finished, (3) quantity rejected, (4) date issued, (5) date due, (6) date finished, (7) main material used, (8) tool number, (9) order number, (10) description, (11) requisition number, (12) drawing number, (13) serial number, (14) pattern number, (15) operation number, (16) man, or machine number, (17) time allowed, (18) number of pieces finished, (19) date finished, (20) previous unit cost, (21) estimated unit cost, (22) design time, (23) pattern time, (24) manufacturing time, (25) total time from records, (26) total time from tabulating, (27) detailed total cost of order, (28) detailed unit cost of order, (29) brief name of tool, (30) department used in, (31) tool estimate in detail, (32) date order typed, (33) date estimated, (34) date designed, (35) date pattern ordered, (36) date shop order issued, (37) date finished, (38) date costed.

We now have a complete and condensed history of the tool stock, the order for it and the progress of the order. Practically any information that is desired concerning the tool is obtainable from the one combined record. It is, however, frequently important to know what tools are used in making certain manufactured parts. We, therefore, have the tools listed by part numbers, which is accomplished by combining in one Kardex pocket, a tool list with a part-number route card, Fig. 6. This combined record gives the following information

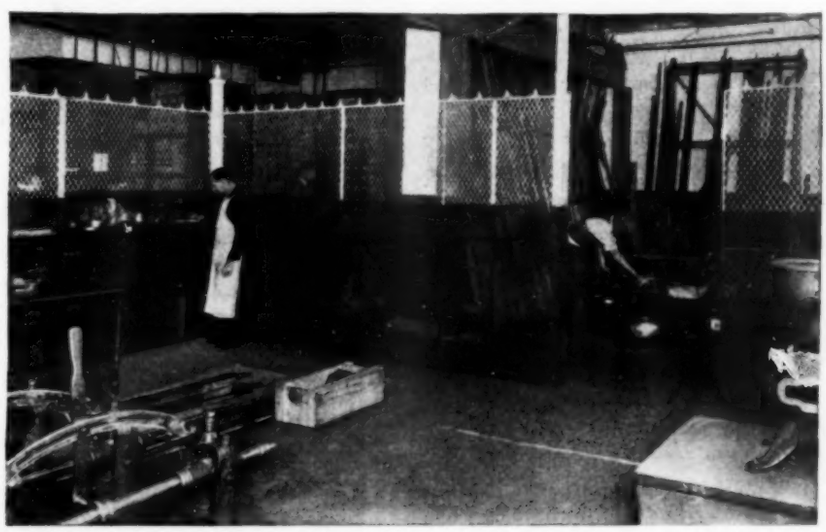


Fig. 2—The tool-steel storeroom and central toolcrib where all tools used in more than one department are stocked, carrying out the centralization plan. This room is adjacent to the toolroom and the tool-control department

The second part of the article. The third part will appear in an early issue.

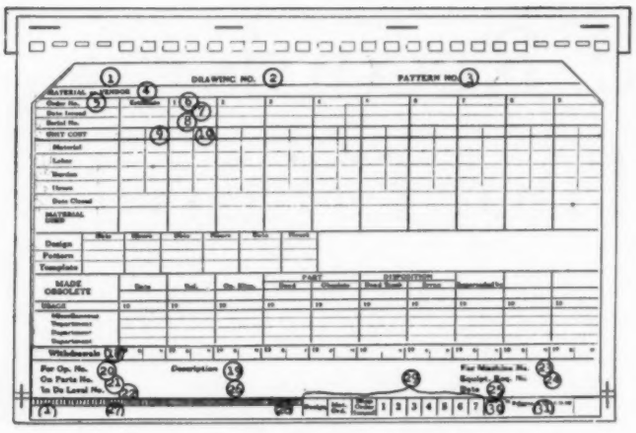


Fig. 3—Master tool record

garding a part: (1) Part name, (2) part number, (3) special information, (4) routing date, (5) when effective, (6) operation number, (7) operation name, (8) line number, or cross index, (9) department number, (10) machine tool number, (11) time allowed for productive operation, (12) material specification, (13) material routing, (14) pattern number, (15) drawing number, (16) date of changed routing, (17) tool number, (18) product number. This combined master route-card and tool list gives complete information regarding any manufactured part, such as: The material the part is made of; the operation to be performed; the departments to do the work; the time it should take for each operation; and the tools necessary to perform each operation. Of this information, the last item only has to be entered, as all other data has already been typed for other purposes. A copy of the original information compiled by the time-study department is used, and is merely tied up with the tool records. This information is valuable for the tool designers, since they have all the data regarding the uses of the tool in question, instead of a disconnected and half-baked story of the situation. Similarly, when a part designer considers the change of a part, he can immediately determine all the tools that are in stock, or in use, that will be affected by a proposed change in part design.

Each department using a tool is furnished with a location card giving all necessary information. In order to be sure that this card is kept up to date, a duplicate of it is kept in the tool-record division and is filed by department and by tool number. For all tools charged to plant account, this duplicate location card is used as a depreciation record. This card, Fig. 7, gives the following information: (1) Tool number, (2) brief name, (3) department number, (4) complete description, (5) date first order started, (6) due date, (7) charge account, (8) date, (9) order points, (10) maximum balance allowed, (11) drawing number, (12) pattern number, (13) part number used on, (14) operation used for, (15) machine tool used in, (16) location, (17) reference to old tool number, (18) equipment requisition number, (19) change notice number, (20) serial number, (21) total cost, (22) what to do with it in case of obsolescence.

This card is always checked against the master tool-record and the entry is made in the cross index before filing. In other words this is our communication between the other two files. The three files combine all the information formerly scattered throughout six separate departments, in addition to much more valuable and pertinent data, which was thought good to know, but was too expensive to maintain under the previous system.

A diagram giving the routing documents involved in the course of issuing a tool order, is shown in Fig. 8. Red tape, some one may say. Let him consider the annual cost of tools in the average manufacturing establishment, and then state that the "safeguards" herein described and included in the control of an annual expenditure of a quarter of a million dollars for tools, are not justified. These "safeguards" are being maintained in our plant at a less cost than the former system, and with practically 100 per cent reduction in tool shortages.

The best way of describing the use of the records is to follow the procedure of a specific tool order all the way through. There are different kinds of requisitions, depending upon where they originate, but the procedure for all of them is so similar that an equipment requisition from a production department will serve as an example. The machine shop, department 14, needs a mandrel for holding No. 4798 tread wheel while grinding the outside diameter. As it is always necessary to have one of these mandrels available in the toolcrib, the foreman writes a requisition for two mandrels, suggesting a danger point of one, an order point of two, a maximum balance allowed of three, and the time for delivery four weeks. This requisition is sent to the tool control. The tool engineer gives the main dimension, 8.54 mm. diameter, the first four digits of the tool number, 5221, and a total estimate of $9.50 per unit.

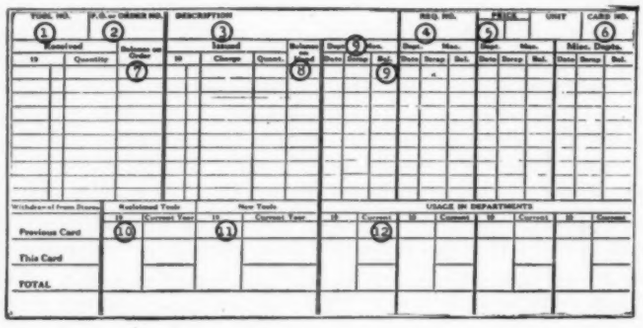


Fig. 4—Balance card

The requisition is then submitted to the tool supervisor for approval and is referred to the tool-record division. The tool-record supervisor checks it against the records to see if there may be a tool in the plant suitable for this operation. This check is a very simple one, if it is borne in mind from the classification previously described, that mandrels less than 20 mm. in diameter will be found in

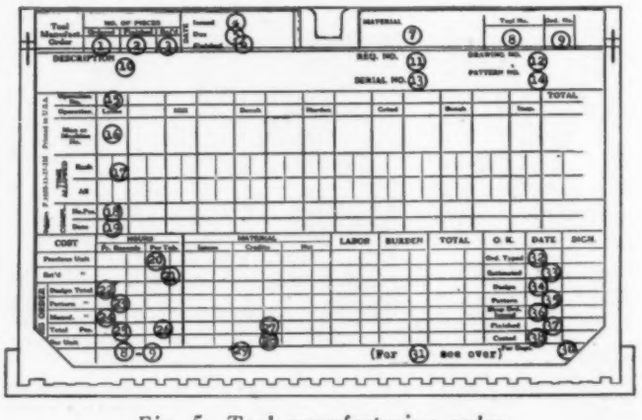


Fig. 5—Tool manufacturing order

the records starting with the digits 5221—. The tool number, which has had the first four digits assigned, is now completed and becomes 522143. This number will from now on become the identification number of this particular mandrel as long as it is in use. To begin with, the number is used as the order number, with the addition of —1, indicating the initial order. Replacement numbers take the next dash number, but the six-digit number always remains the same. As this order is the first one for this tool, the serial numbers 1 and 2 are assigned, because the order calls for two mandrels. Each tool is given a serial number in addition to the tool number, so that if at any time the tool should not perform satisfactorily, the details of the material and the method used in making it may be investigated. The serial number identifies each tool with the order on which it was made. After approval

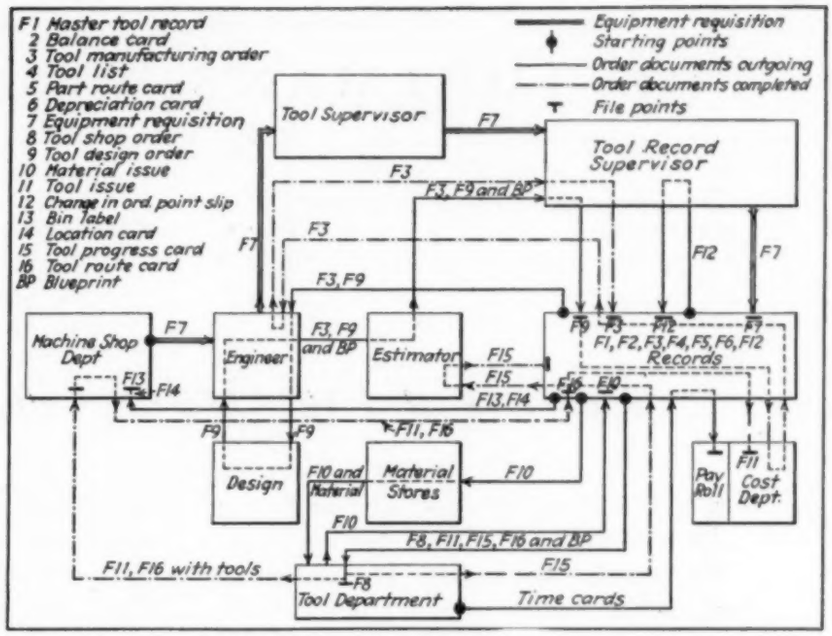


Fig. 8—Procedure of issuing orders

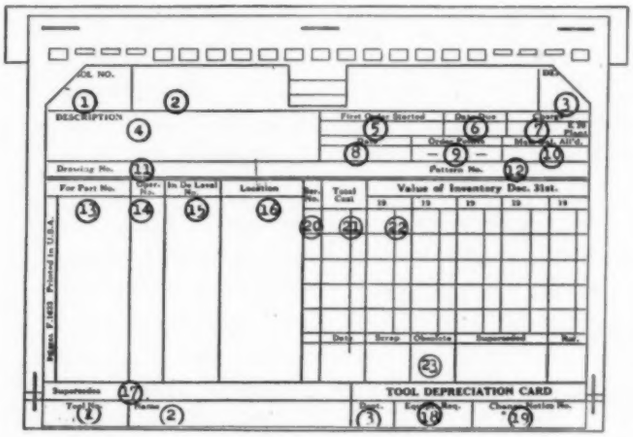


Fig. 7—Tool-depreciation card

by the tool-record supervisor, the tool order is typed from the requisition. To save retyping and to prevent typographical errors, all forms are so designed that the vital information is typed on four copies at once, and later, several "Ditto" copies are made from the original.

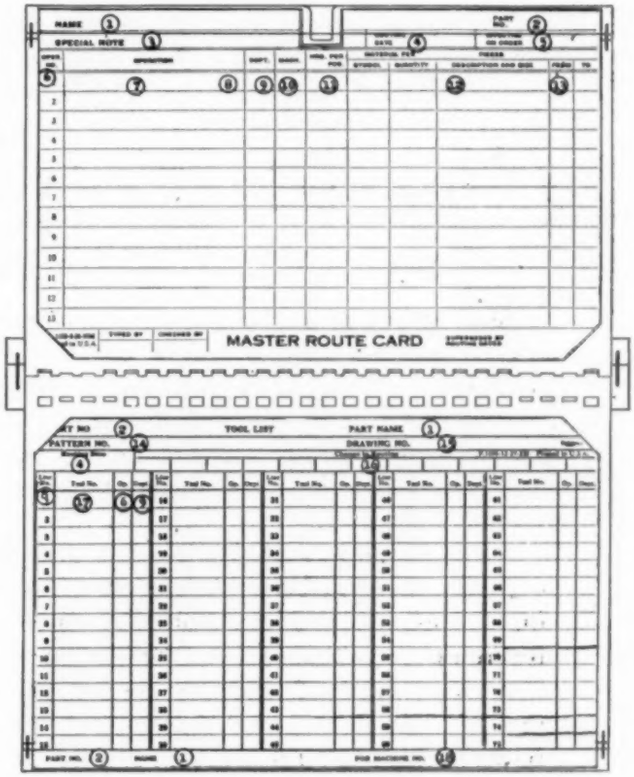


Fig. 6—Tool list and part route-card

High-Strength Brasses Capable of Heat-Treatment

IMPROVEMENT of brass for many purposes by the addition of small amounts of nickel and silicon was discussed in a paper by W. C. Ellis and Earle E. Schumacher of the Bell Telephone Laboratories, at the annual meeting of the American Institute of Mining and Metallurgical Engineers held in New York, February 18 to 21. These brasses can be hardened by heat-treatment and aging in much the same manner as the duralumin type of aluminum alloys.

Nickel-silicon brasses contain only small amounts of nickel and silicon, and are not to be confused with the commercial German silver or cupro-nickel alloys. The nickel, usually about 2½ per cent, forms a chemical combination, or nickel silicide, with the silicon which is usually about 0.60 per cent. In combinations containing 10 to 20 per cent of zinc the heat-treatment resulted in an appreciable increase in hardness. They were quenched from a temperature of 875 deg. C. and aged one hour at 550 deg. C. Alloys of this composition are also used in the manufacture of high-strength brass castings.

Phosphor bronzes containing from 4 to 8 per cent of tin have apparently the same hardness possibilities by the addition of nickel up to 3 per cent, and the small amount of silicon. They have high tensile strengths and can be hardened appreciably by quenching and aging.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Letting a Big Order Go Elsewhere

"I HEAR that Williams advised the big boss not to take that big order for special pumps, Al. That seems a funny sort of notion to me. I should think he'd want all the work he can get into the shop."

"There are several ways of looking at that, Ed. Williams told me about it on the train last night. And don't think Williams *likes* to turn down a big order."

"Well, why did he?"

"You know, Ed, we are full of work. This order would have made it necessary to hire a lot more men. And where are we going to get them?"

"Must be lots of men who want a job—or who would like to change jobs. Guess we could get men from almost any shop in town if we tried. Or, we could send a scout to Cincinnati or Detroit and pick up all we needed. I don't like to see good jobs going to other shops."

"No more does Williams, Ed. The big boss felt as you do about hiring men from other shops, but Williams knows it means disrupting other organizations, and having to let a lot of men go when this big job was done. It means that new men have to be broken in to our work, and you know what that means in balling-up the shop. You kick now because all your men are not hundred per centers—it would be a darn sight worse then."

"Can't this shop ever grow because it might interfere with somebody else? How does any shop expand? If it can't get men from outside, it might as well quit."

"Now you're getting excited, Ed. Of course our shop can grow, and I don't at all object to getting men from other shops. Sometimes it is a good thing all around. But Williams knows what he's about in this deal. He knows that a slow, steady growth is a lot more healthy than the other kind. He knows that it would upset the shop, and that output would not increase nearly as fast as the payroll."

"So he'll let someone else get that big order. I'd sure like to see it come in here, Al."

"So would Williams. And it's possible that it may come yet, if they don't find anyone else who can handle it sooner than we. But Williams has had experience enough to know that it sometimes pays better to let the other fellow take a job than to do it yourself—if it's going to cost you more than you get. There's a lot more to running a shop like this, Ed, than just handling our departments. Williams has to figure on a lot of things that never bother us. And this idea of sudden enlargement is dangerous in most cases. It seldom works out as it should."

Should Williams have hired men wherever he could, and taken the order? Or was it safer to let it go? Is anything gained by sudden and temporary expansion?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Whistling in the Shop

WE HAD a man in our shop who whistled continually, but his fellow workmen never paid any attention to him, and the work of the men in the shop was in no way curtailed due to this whistling. As a general rule, I think it will be found that the men who object to whistling in a shop are those who are of a nervous disposition. Other noises in the shop probably affect these nervous men in some way or other, but they say nothing concerning them. How about the hum of the machinery such as noticeable in a machine shop? These noises are just as bothersome as whistling, provided one listens to them.

Let's concern ourselves with the big problems in the shop, and not with the trifling matters, such as whistling. Life is too short, and probably would be a whole lot shorter for the whistling man, if such practices were prohibited. A real shop foreman knows how to step in when the actions of his men are cutting down the efficiency of the work. As long as the work is being done in an efficient and economical way—whistle away!

—H. E. BAUGHAM, *Engineer. Portsmouth By-Product Coke Company.*

Gang Bonus in the Shop

I CANNOT help but feel that Ed is right in declaring that the gang bonus "cuts out" the individuality of the men. Individual reward for individual effort is the most direct and successful way yet devised to "pep" up work. With all the current effort to provide rewards for beneficial suggestions, and to reduce each man's job to well-defined tasks, the gang bonus looks like a backward, rather than a forward, step. Having each man tend to his own job is the practical way of handling the production problem.

The gang bonus may at times succeed in providing the necessary and justifiable criticism of the laggard by his fellows, but it is just as likely to lead to endless controversy that serves no real purpose. In old established, small community organizations, where jobs are handed from father to son, and all the employees are like one big family, the gang bonus may have a chance for success. But in big city concerns with the inevitable labor turnover incidental to such locations, the odds are all against it.

—GEORGE NEILL.

A PLAN modeled after the following is in successful operation in some plants instead of a group bonus:

1. Rate all men by a guaranteed hourly rate, arrived at by weighing years of service, quality of work, versatility and conduct; plus a base starting wage.

2. Set rates on all operations in terms of "pieces per hour," giving due allowance for operating conditions. All production over this base task of "pieces per hour" shall be paid the individual at his regular hourly rate, i. e., a production of 300 pieces per hour on a job having a task of 200 pieces per hour would pay 50 per cent.

3. All bonus above his guaranteed hourly rate, earned by an individual, shall be paid him as follows: One half of his total bonus to be paid on his regular pay day, one fourth to go into a pool to be divided between all the men in his group pro rata to their guaranteed hourly rate, after deductions have been made by the company for jobs which have fallen below base task. The remaining one-fourth of the bonus to go into a bonus to indirect labor and service departments such as foreman and other supervisors, stockmen, truckers, millwrights, oiler, planning department and toolroom. Inspectors should not enter the bonus plan in a way to have production form any portion of their earnings.

—PAUL M. HATFIELD.

THE · NEXT · TOPIC

Rehiring Old Employees

ADVANCE QUESTION

Bob Walker quits and Williams plans to rehire Jack Thompson, an old employee. Ed says it is all wrong, that the men who stayed with the firm should be given first chance. How do you feel about it?

Preventing Spoiled Work

THE need for instructing the workman properly has increased because the work has become so highly specialized. In bygone days the workman had a much better chance to get some education out of his work, and to learn the proper method of doing work, than has the worker of today, because he used all the tools in the place and made all the parts of an entire job. Yet, he would not have been able to take full charge of completing the job without the instruction of the foreman and his patient educational influences.

—J. GURWITCH.

SPOILED WORK is something that worries all of us here who are responsible to the firm for it. We certainly don't allow anyone to take it for granted that their judgment alone is all that is needed on the work that they are doing. Each time that a hand is given a job, the foreman is required to warn him of the class

of work it is, how much attention is necessary to finish, and the important dimensions. In addition all blueprints carry notes of any points that will help to avoid spoiled work.

No mechanic, on a really important work running into money, should be allowed to go on with the job to completion without being checked up frequently by the foreman or inspector.

—CHARLES H. WILLEY, *Ass't Plant Sup't.*

The Foremen's Ideas on Pensions

THE problem of adequate relief for the older men in the shop should be studied carefully, because there is nothing more discouraging to other men than to see men, a few years older than themselves, dropped for one pretense or another, without thought being given to their future welfare. It begets a feeling of insecurity, and is detrimental to the continued loyalty of the workers to the company.

Of course the idea is advanced that individual saving could have helped in a situation of this kind. But it should be remembered that few workers are able to save. Sickness, accidents, lack of work, all tend to prevent saving. As a remedy for this condition, the adoption of a pension system will be found beneficial.

—HARRY LACKMAN.

THE largest business organization of the country, the Federal Government, pensions all its old employees. This is a plan which should be, and in the course of time will be, adopted by a large proportion of all industrial and commercial organizations.

When a man knows that he will be retained in some capacity, of value to himself and his employer, as long as he is able to perform useful work; and then retired on a pension, his attitude toward his work and firm takes a turn for the better. His interest in the work increases. He is more loyal to his employer and associated workers. He considers himself a part of the business, and not merely a temporary hired hand.

—L. O. BROWN.

ED'S idea that pension schemes savor of charity needs considerable revision. No high official in state or professional service considers it beneath his dignity to accept a pension.

In Britain the banks have largely followed the lead of the civil service and scholastic professions with regard to the granting of pensions. Several leading industrialists include a pension scheme as part of their employment policy. Many industrial firms and such large amalgamations as the Imperial Chemical Industries, provide such facilities for those who have staff rank. There can be no question that the assurance of a reasonable pension at a reasonable age makes a difference in a man's outlook.

—W. R. NEEDHAM, *England.*

More Responsibilities for the Foreman

IT IS taken for granted that the foreman is responsible for the quality and quantity of work which his department produces. The efficiency of his department is gaged by these two factors. However, some foremen, in an effort to make production records, lose sight of the quality factor, while others watch the quality to such an extent that production is seriously retarded. The best foreman is the one who balances the two factors properly, producing the greatest quantity of work, of the requisite quality.

Ordinarily, it is impossible for the foreman to watch both production factors; something must be left to others. If the mechanic does not understand the blueprint, if he is not sure his machine is set up right, or if anything at all seems wrong, he should report to his foreman. That is his responsibility.

It is not to be expected that every mechanic should have as much experience or foresight as the foreman, otherwise a foreman would not be needed. But, if every mechanic were absolutely free of responsibility, a foreman would be needed for each of them. As both of these conditions are impractical, it is obvious that the responsibilities must be divided somehow.

—R. H. KASPER.

TO LOOK at in an abstract way, it may seem as if Williams is asking a lot when he insists that the foreman check the accuracy of the first piece of a run and be certain that blueprints and fixtures are O.K. Yet while doing this, he is in a position to perform the major part of his work in relation to the men, at the same time. It is much better to crystallize instructions or detail information in terms of a concrete job, than it is to give such "dope" in a general way. It not only performs the direct function for which it has been instituted, but it provides the direct application of supervising instruction.

That the checking should be done by someone is too obvious to argue. An inspector is not exactly the proper person, since he is primarily interested in discovering the error, and not necessarily, in remedying it.

—JAMES F. FITZGERALD

IF WE come right down to "brass tacks" the foreman's only duty is to get the work out right and on time. Everything else is only a means of accomplishing this.

It is not necessary that the foreman go around himself, "mike" in hand, and check every first piece, but one of his inspectors can do that readily. The foreman should organize his department so that the checking of first pieces will be an automatic routine. He is responsible when things go wrong, and what he cannot do personally he must arrange to have done. That is where real foremanship comes in. —J. C. P. BODE.

THE foreman's first job is to see that the largest possible percentage of the work that is done in his department is done correctly. Spoiled work costs the firm more than the same pieces made correctly, since the cost includes every charge made against the good pieces, including overhead, plus the costs of salvage.

Whether or not it is the foreman's job to check over first pieces, will depend on the number of his other duties, which may be decided by the size of his department. But if he cannot do the job himself he should appoint someone else to do it. This someone might be a man from the inspection department, although many foremen object to inspectors outside of their control handling the work until it has left their department.

—A. F. GUYLER, *England.*

Fixtures for *Lancia* Rear Axle Housings

By J. A. Lucas

Milling and drilling operations with tools that are both unusual and efficient—Permanent fixtures that do not interfere with other work

REAR axle housings for the Lancia bus are steel castings made in Switzerland. The housing is continuous, having wheel supports at the ends and a full-floating axle inside. The first operation on the housing, after visual inspection, is to lay it out. It is supported at three points by small screw jacks and a center line scribed the whole length of the casting, dividing the metal so as to clean up to the best advantage. It is then turned 180 deg. and checked.

To equalize the wall thickness the casting is centered on two expanding mandrels, and the outside of the two ends, and a bearing for the steadyrest are machined. It being impractical to finish turn for ball bearings with expanding mandrels locating from a rough surface, the latter are removed and the casting is supported from the surfaces just finished, while the inside of each end is machined for a short distance to receive a center plug, or disk. These disks, one at either end, are drawn together by a heavy strap-bolt extending through the casting. This relieves the longitudinal strain on the lathe centers, and also helps to brace the casting. Elaborate precautions are taken to prevent sagging or bending. Screw jacks brace the walls of the differential opening, and the strap-bolt is held central with the bore.

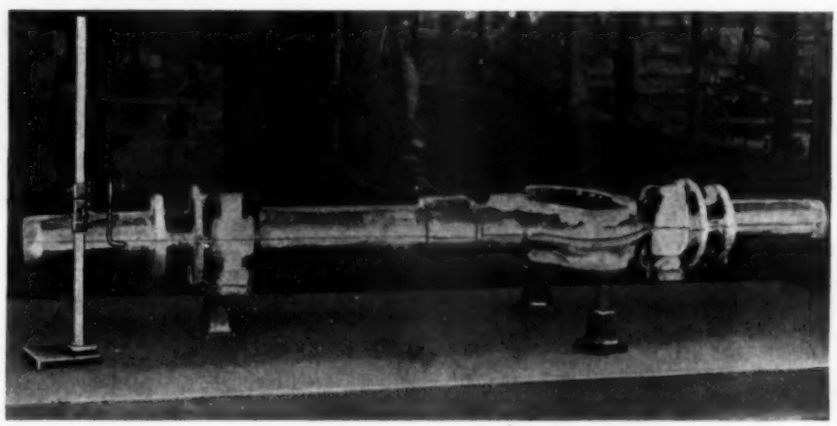


Fig. 1—Laying out the axle housing on the inspection table

These precautions, in addition to the steadyrest, insure alignment. In this position, the flanges for the brake drums and the bearings surfaces are finished turned, and the ends are threaded for the hub retaining rings. The tolerance allowed on the bearing surfaces is 0.0008 inch.

Using the turned ends to locate the housing, the surfaces for the differential carrier and its housing are milled as shown in Fig. 2. Short screw jacks under the gear opening take the thrust of the milling cutter. After turning the housing 90 deg. and locating it by means of the angle plate at *A*, Fig. 3, the spring seat pads are milled with the same cutter. The gage used for checking the milled surface is seen at *B*.

Several drilling operations are performed on the large radial drilling machine shown in Fig. 4. A fixture is located on each side of the machine, leaving the regular drilling table in the center, available for any work that may be required. These fixtures are permanently located so as to be always ready, avoiding any loss of time in setting them up.

In Fig. 5 one of the fixtures is being used for boring out the central case to receive the differential carrier. The housing is held in the fixture and clamped on the steadyrest bearing. The head used for boring the gear housing is a good example of the general design of both tools and fixtures. The bar is piloted in a bushing in the fixture casting. Another operation on the same fixture is shown in Fig. 6, where the spring pads are being drilled for the clip bolts. The drilling plate for the gear housing is shown in place. Incidentally, the same view shows the type of tool stand used in the Lancia shops. Every tool needed for this particular job is on the stand, convenient to the operator. When the job is done, the whole stand can be easily rolled on its base, into the adjoining tool room.

The construction of the fixture itself is seen clearly in Fig. 7 where it is shown tipped up to show the interior. The banjo cover jig has been removed. The bearings in the trunnion at each end of the fixture, show clearly. This view also shows the pilot bushing for the boring bar, and other guide holes for boring bars, as well as the various drill bushings.

On the other side of the drilling machine there is a housing in the pit with one end uppermost, ready for drilling the holes in the two flanges. This view also shows the quick-acting clamps used on the end of the housing, that locate it vertically under the drilling spindle. The drill jig shown is used for drilling the flanges. It fits over the end and is located from the center hole in the spring pad, and clamped by the handle. By using an extension drill it becomes an easy matter to drill the 22 flange holes at one setting and so insure their correct

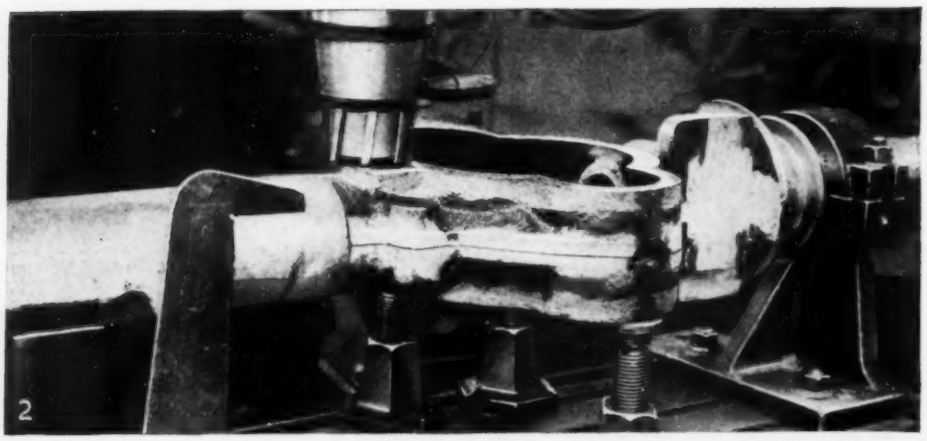


Fig. 2—Milling one side of the "banjo" face on a vertical spindle machine. The housing has been previously turned at the ends, and is supported by small screw jacks

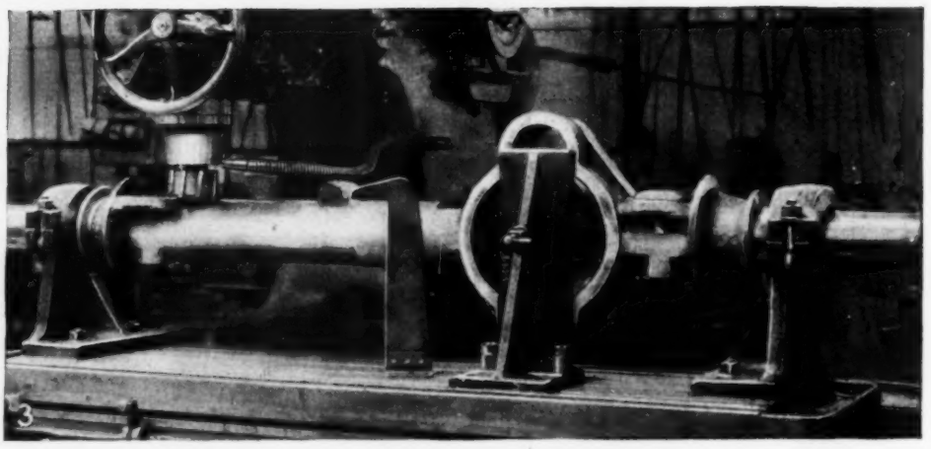


Fig. 3 — Milling the spring pad seat in the same fixture, locating the banjo at 90 deg. by means of an angle plate

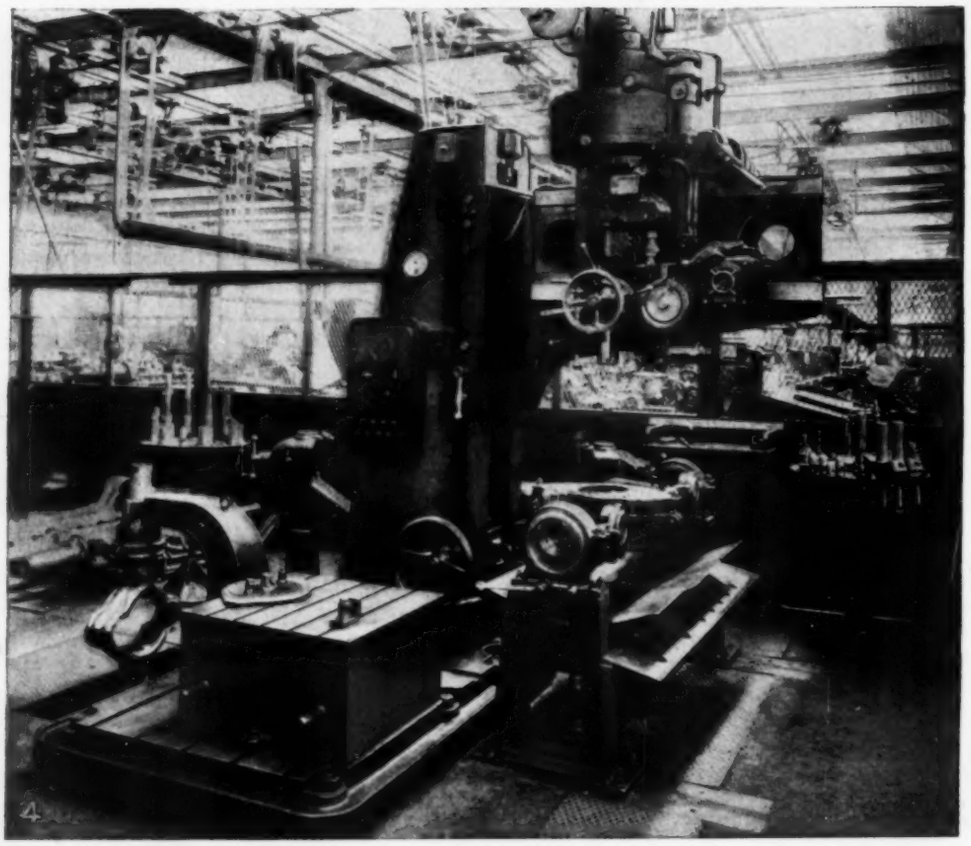


Fig. 4 — Large radial drilling machine equipped with special fixtures on each side of the main table to handle housings and yet not interfere with regular work

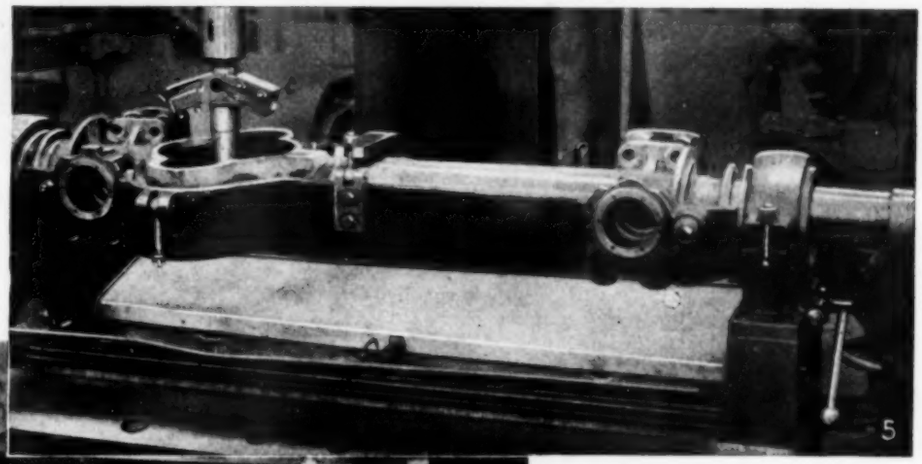


Fig. 5 — Boring the banjo in a fixture under the radial. The boring bar is guided in a pilot bushing in the fixture

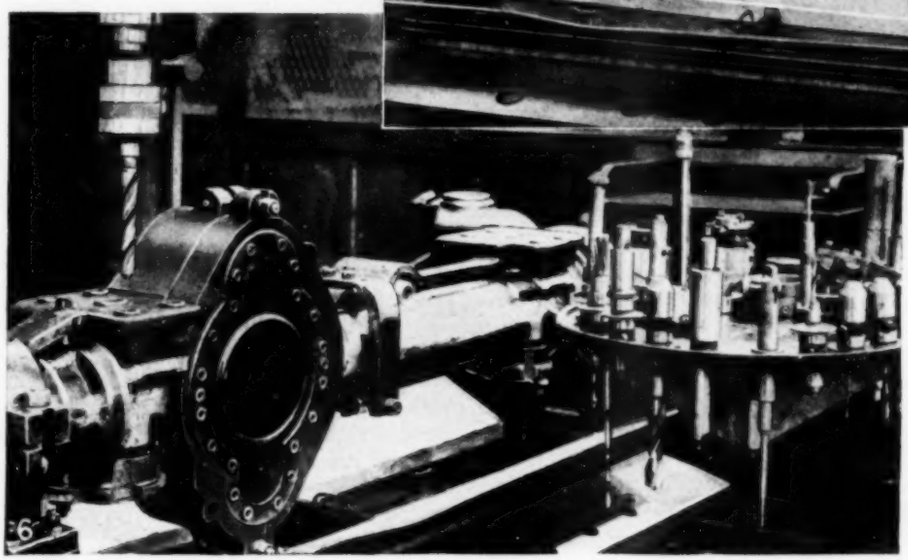


Fig. 6 — The same fixture as shown in Fig. 5 used to drill the spring clip bolt holes in the spring pad. The bushing plate for the banjo is in position, and the tool stand is shown

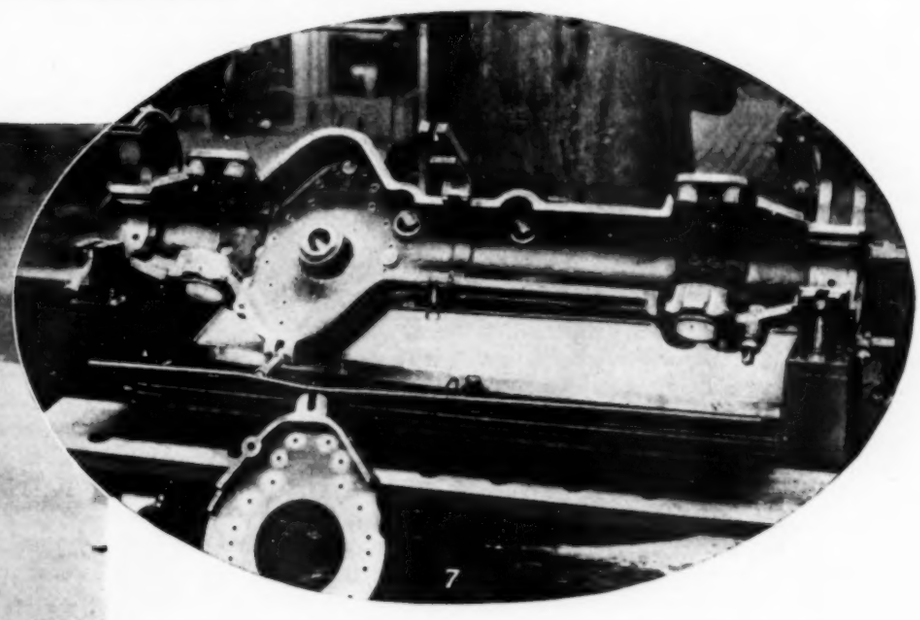


Fig. 7—Fixture with housing removed to show details of its construction. This shows how ends of axle housings are centered and clamped

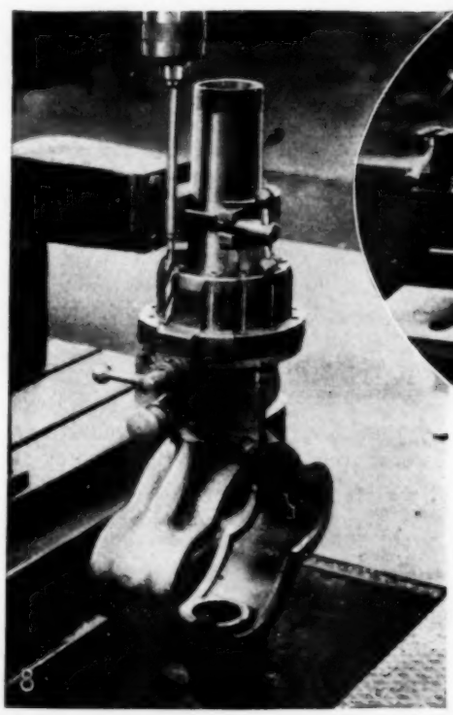


Fig. 8—Drilling the flange holes with the housing on end in the pit at the side of drilling machine. This shows how the housing is clamped and the drill fixtures used

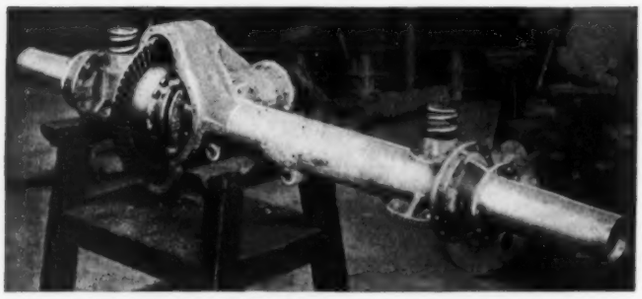


Fig. 9—Completed axle housing partly assembled. The differential and ring gear are located at one end of the table

location, in relation to not only one another, but also one row with another.

A partially assembled rear axle is seen in Fig. 9, which shows how the ring gear and the differential housing fit into the banjo. It will also be noted, both here and in the previous illustrations, that the differential housing is not in the center of the housing. This, as was pointed out in an earlier article, is to get the driving mechanism away from the center of the bus and under the seats on one side. By doing this the floor can be dropped much lower than it could be if it had to clear the transmission and differential housings.

Effect of Industrial Standardization Studied

INDUSTRIAL standardization has been a paramount factor in the recent economic progress of the United States, and cumulative evidence points unmistakably to the conclusion that it is one of the most significant and far-reaching methods for increasing industrial efficiency to the benefit of all interests concerned, according to the National Industrial Conference Board, New York City, which recently made a study of the industrial standardization movement and its effects upon economic life. The Board is inclined to attribute great potential value to the effects of standardization upon social and cultural progress, provided the evidence found in support of the net economic benefits of the movement should prove conclusive. Quite contrary to populer impression in many quarters, that standardized consumers' goods and standardization in industrial and commercial methods tends to develop stereotyped living conditions and habits, the Board declares that if the machine (through standardization and mass-production) is able to democratize leisure, it may be opening up the way for the greatest cultural renaissance in the history of the world.

Standardization, the report points out, means many things besides the mere standardizing of product as to size, quality, design or of methods and procedure in the productive process proper. It is applied in increasing degree to the functions of business procedure in all its branches, as in purchasing specifications and in clerical work.

Standardization should be regarded as a tool, a method, a device or a technique for achieving certain ends, the Conference Board declares. Whether or not advantages outweigh disadvantages is found to depend entirely upon what use is made of standardization, as it may retard as well as promote industrial progress. In practice, judgment as to particular standardization projects or as to standardization in general must rest upon a satisfactory answer to the following three questions:

1. Does standardization have the effect of forwarding technical scientific improvement of processes, techniques and equipment?

2. Does standardization make possible a higher average standard of living?

3. Does standardization relegate problems already solved to their proper place, the field of routine, leaving creative faculties free for the problems still to be solved?

Available evidence emphatically supports an affirmative answer to the three questions.

The danger that standardization may impede industrial and technical progress by tending to stereotype existing methods and designs is recognized, and to avoid it existing standards and methods must be carefully and constantly checked with latest improvements, and machinery for constant and expeditious revision must be provided. Fortunately, America's large industrial organizations that are most active in the field of standardization are also the ones that maintain the most active and progressive scientific research laboratories.

Standardization of product, through its inseparable concomitant, mass-production at lessened production cost, has shifted the major industrial problem away from production to marketing, with the net effect that the ratio of marketing costs to production costs is steadily increasing. This condition has created a situation that in part offsets the advantage of standardization itself, but it may in part be remedied by the simplifying and systematizing of marketing technique.

In foreign trade, the existence of definite standards and specifications for materials and manufactured machinery and equipment has the effect of facilitating purchase both because of the lower price of the standardized products and the elimination of uncertainty as to the character of goods purchased. To a considerable extent, also, exporters may gain a wider market through adequate servicing with standard interchangeable parts.

The Board's study reveals the phenomenal growth in all the industrial countries, particularly during and since the War, of a technique of standardization that plays a basic and necessary part in machine industry. But it also implies a warning that the eventual effects are as yet not wholly clear; that a considerable part of the available data regarding its advantages had to be set aside as of dubious authenticity or as irrelevant; and that there are many questions regarding the effects of standardization which cannot be answered, even tentatively, by an appeal to evidence.

The Engineering Index Service is now available in five public libraries scattered throughout the country as well as in the Engineering Library in New York. The service, which was started in January, 1928, is to be found in the libraries of Newark, N. J.; Cleveland, Ohio; Bridgeport, Conn.; Baltimore, Md., and the John Crear Library in Chicago. An up-to-date running index of articles published in this journal or in any one of 1,700 other journals in all languages is available in card form, thus making available almost any article on any technical subject shortly after publication.

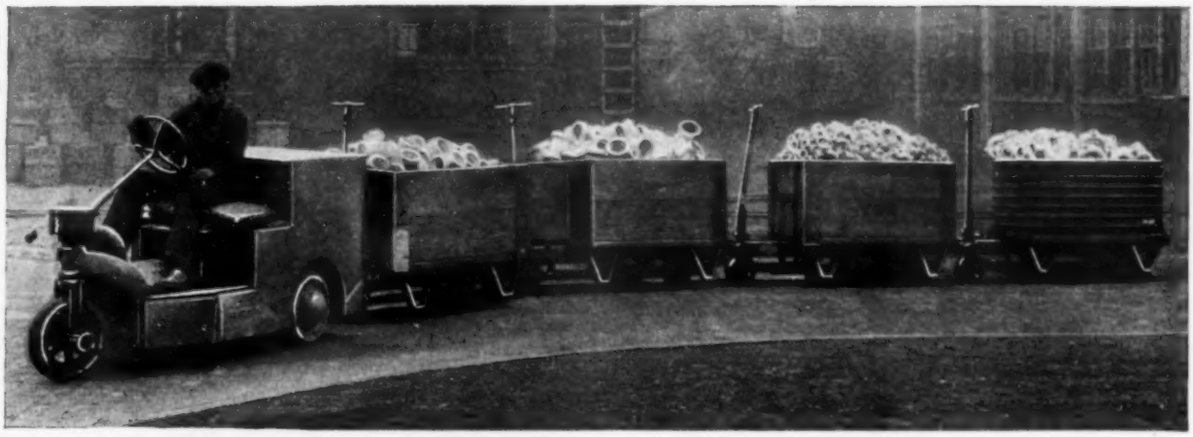


Fig. 1—Bins mounted on skids and lift trucks form a train for transporting material

Moving Material on Skids

By keeping raw material, parts in process and finished machines on skids, they can be moved readily with a minimum of handling

STATISTICALLY-MINDED transportation men claim that 90 cents out of every transportation dollar go to loading, unloading, packing and rehandling of material being shipped. This leaves but 10 cents for the actual transport of the material and shows that a goodly percentage might easily be saved by more efficient handling methods. There is opportunity for much saving both in the shop where the products are fabricated and in their transport to the shipping platform after assembly.

Material handling cost, like taxes and other overhead, is always with us. It begins when the raw material enters the plant, it continues between all the operations that enter into its fabrication and it does not cease so far as the manufacturer is concerned until the finished product is turned over to the transportation company. Material handling includes the lifting of material of any kind from the freight car floor, carrying it to be piled elsewhere, lifting it up for each operation, moving it between operations, moving it to the storeroom or to the shipping department or both, and finally again moving it to the truck, freight car or other vehicle of transport. And each of these handlings costs more money than we are apt to realize. As it is impossible to have the material move itself, the best we can do is to reduce the handling to a minimum. This, in most cases, means to eliminate the handling of each individual piece from the floor to a machine and again to the floor between operations. In other words, to keep pieces, units of machines or the complete machines themselves, off the floor from the time the material enters the plant until it leaves. To accomplish this it is necessary to use some type of lift truck in combination with the skid or platform, the term skid being used to include all forms of carriers used in connection with the lift truck. The skid therefore may be either a plain platform, a platform with any sort of box or bin built on it, or it may have removable sides and be capable of use in various combinations. Furthermore, it may be built of either wood or metal, or of combinations of both. Although it is estimated that there are about 9,000,000 skids and over 100,000 lift trucks in use at present, there are still many cases where full

Fig. 2—Sheet metal bins that are kept on skids both in transit and in storage. Material never touches the floor and can be moved readily with a lift truck

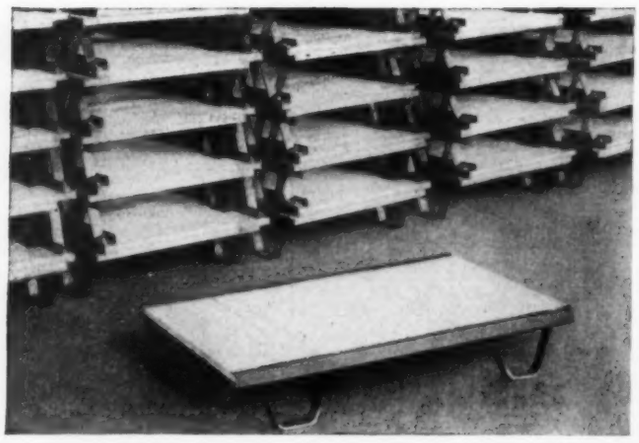


Fig. 3—Stock of skids, nested so as to economize space. These are kept for use as platforms or as carriers for bins or boxes of various kinds. The height is standardized

advantage is not being taken of the savings made possible by their use. In plants where skids are used to the best advantage, the work seldom, if ever, touches the floor. Instead, the incoming parts are placed on skids, stored on skids and moved on the same skids to the first operation. After this is completed the pieces are either replaced on the same skids or on another, ready for moving to the next operation. The work moves on skids all through the plant, and in some cases is shipped on skids to the consumer.

One method of using skids in bringing raw material into the plant is shown in Fig. 1, where the skids, mounted on lift trucks, are coupled into trains and moved quickly from the foundry or forge to the machining department. This illustration shows both wood and metal containers, the use of the lift truck converting them into small freight cars while in transit. As soon as they reach their destination the carriers are deposited by removing the lift truck, which is then free for use in any way that may be desired. One truck can serve from 20 to 100 skids.

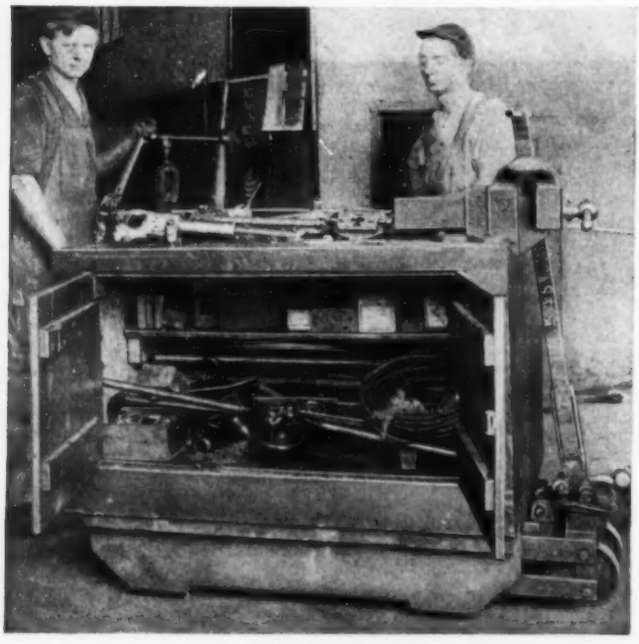


Fig. 4—Emergency repair truck that can be taken promptly to any part of the shop. It contains a substantial work bench, vises, pipe cutters, air tools and other tools likely to be needed

Another type of metal container, this time being moved by hand, is shown in Fig. 2. A convenient form of platform skid is shown in Fig. 3, which also shows how they can be stacked in a very compact manner and so as to occupy comparatively little space. This view also shows how angle irons and steel bars, bent to the proper shape, are used in the construction.

Repairs can always be facilitated by having the tools ready, and transporting them to the job without loss of time. Fig. 4 shows how this is accomplished in the plant of the American Tool Works. The emergency repair outfit shown includes a substantial bench with a large cupboard underneath. The whole thing is permanently mounted on a skid so that a lift truck can pick it up and carry it to any part of the plant at very short notice.

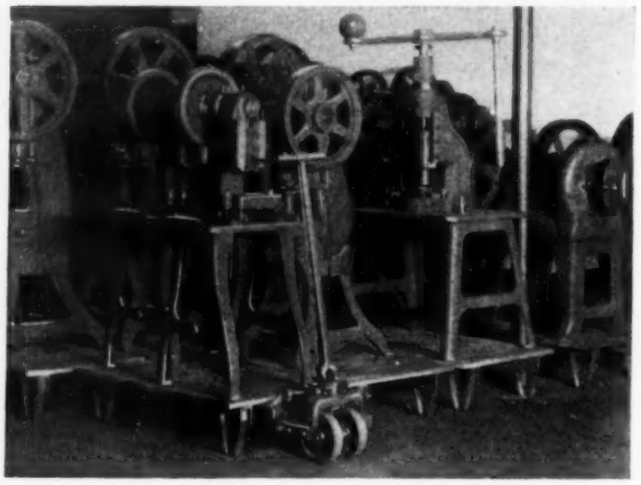


Fig. 5 — Storing completed machines on skids ready for boxing and shipping. They take up no more room and can be moved to the shipping department or into a box car with minimum effort

A good example of the way in which finished machines are stored on skids to await shipment is shown in Fig. 5. Machines stored in this way take up no more room than on the floor and when it becomes necessary to move them they require no crowbars, rollers or other strong arm methods. A lift truck rolled underneath picks them up and carries them to the place where they are boxed or crated. When ready for shipment they can be rolled into the freight car and deposited on the floor in much less time than by the old method of handling. This method saves considerable cost in handling both in the shop and in loading in freight cars for shipment. It also permits the recipient to get the machine out of the car at much less cost than by the old method. The saving in men and in time usually required for this work is well worth considering.

This means of handling is made possible by the standardization of heights on trucks and skids. The "low" heights of lift trucks are now made 7, 9 and 11 in. The skids are $\frac{1}{2}$ in. higher in each case so as to give the necessary clearance in running the trucks under the skids for lifting and moving.

Traffic on the Deutsche Lufthansa air lines included 60 per cent more freight last year than in 1927. They carried 111,000 passengers, about 2,500,000 lb. of freight, nearly 2,000,000 lb. of mail and baggage and flew approximately 6,500,000 miles. These are startling figures, and indicate what lies ahead in this country.

Production with Standardized Units

Rebuttal

By Herbert E. Taylor

M.I. Mech.E., M.I.A.E.

In reply to comments and criticisms published on his article, which appeared on page 3 of this volume, Mr. Taylor offers additional evidences of the merits of his plan, and points out some of its further practical cost-reducing possibilities

THE publication of my article on "Production with Standardized Units," in the *American Machinist*, Vol. 70, page 3, appears to have met with a generous response. The discussions presented on page 61, are, in general, so favorable that I am greatly encouraged to go further with my developments: The few major objections raised have resulted more from the apparently radical nature of the proposal to manufacturers and engineers, and their lack of opportunity thoroughly to sound out its possibilities, than from any real flaw or limitation in the plan to build up machines from standardized units for complete cycles of continuous, straight-line production.

I agree with the point raised by Lucien I. Yeomans in his discussion, that a name is necessary for the new production method, but I have not thought of a good one.

The station-type machine, which I introduced in 1911, only partly accomplished my object. The station principle, built up into a series of machine units, of which Mr. Yeomans gives some American examples, is a great advance, but the possibilities have hardly been touched. This principle can be utilized in practically all machine operations, and I applied it to assembly in 1918. Under more extensive use, it would result in the more rapid development of the standardized units for drilling, milling, etc., which manufacturers of different types of machine tools would be called upon to supply.

I agree that structural steel would do for a frame on which to mount the units, and I proposed it in my original paper. My ultimate aim contemplates a complete manufacturing machine, built up of units, all interconnected. But this final goal may lie 20 to 50 years ahead.

Ralph E. Flanders raises an economic question. He asks whether the application of the idea is not so limited that machine builders will find only a limited outlet for standardized units, and cannot sell them at reasonable prices. My proposal is that the different units be built by the regular manufacturers of each type of machine tool, such as milling machines, drill presses, etc., the only general standardization necessary being in attachments and electric equipment. The units would thus incorporate most of the working mechanisms of present machines and retain volume production for their makers. Changes required in units for a change in design of product can be much more rapidly and cheaply introduced than with present machine tools. This facility offers one of the primary reasons for using units at all, and explains why I so strongly urged interchangeable units, to be followed later by standardization of parts.

A special machine is scrapped when the product for which it is designed is altered; hence the present trend to use standard machines equipped with special attachments, jigs, etc. As a result, a complicated machine, in which very few movements, speeds, and mechanisms are utilized for a given job, is loaded with special equipment, often costing more than the machine, to enable it to produce efficiently. With units, the same results are obtained, as, for example, in the case of the connecting-rod line illustrated in Vol. 70, No. 1, page 3. But all that is required for a change in product is to take the unit apart, alter the fixture and spindle-carrying plate, and re-assemble the mechanism. Most of the parts are re-used, and therefore expense is saved, as well as the time otherwise necessary to machine new parts. Moreover, it is a much easier job to bolt up the altered units on a machined face than to set up a new machine on the floor.

A fair comparison of the relative expense and delay caused by changes under the present and the proposed methods must take into account the equipment installed to automatically time and automatically transfer work between processes. It is much simpler to introduce this equipment in connection with units than with regular machines. Incidental facilities, such as automatic clearing of swarf, oiling and cooling systems, etc., can be much more easily provided on assembled units.

Four points requiring special consideration are listed by R. R. Keith: Quantity of production per day; obsolescence of product design; accuracy of operations; and combination of equipment to avoid its obsolescence when a change of design of the product occurs.

The unit system meets all his points. First, if the quantity produced is small, only certain stages of the system would be used. The complete unit scheme would be utilized only for large production. Second, the obsolescence of design of product is met in the same way. Third, from the standpoint of accuracy, the results are much better with units than with standard machines, because all parts of the producing equipment are guide-bored, or otherwise locked together. The gearbox production line, pictured on page 4 of the original article illustrates this principle. With all its faults of design, this machine produces gearboxes more nearly accurate than those made on standard machines. The fourth point raised by Mr. Keith, obsolescence of equipment, is answered above in comments on Mr. Flanders' discussion.

I have always been against any complex sequence of

operations. The unit system is devised to combine processes in a simple and readily changeable way. The units are, of necessity, more highly standardized than the usual machine tools. They possess infinitely greater flexibility to meet changes in design of product, or adaptation to other work, and are devised to perform operations more economically than regular or special machines. Units take up much less floor area than such machines. The photograph of the gearbox unit machine shows that each box nearly touches its neighbor. The conservation of space is self-evident. With regular machines, the total area occupied by the equipment would be several times that required for the unit machine, because of the greater size of the individual machines and the area wasted between them. In most cases, from 50 to 75 per cent of the floor area is saved over that necessary for a layout of standard machines, because successive operations touch, and the conveyors are usually in the table of the machine itself.

Establishing a Locating Plane

There is no fundamental difficulty in establishing a primary surface to form a locating plane for succeeding machine operations, such as Mr. Keith suggests may occur at the first stage of the system. Moreover, the same problem is present with existing standard or special machines. When a changeover is necessary at some point in the operations, to reset the piece, but still work from the primary locating surface, an operator is stationed at that point. This method is followed with the gearbox previously mentioned. An operator would also be required for a similar purpose on the usual machine of standard, or special, design.

E. J. Kearney is right in stating that I am searching for an increased output per worker, with increased overall efficiency. Human capacity for work can most profitably be utilized to control and direct operations. The timing of transfer units of the proposed system cut out much of the monotonous work associated with the present system of mass production.

It is claimed by C. L. Campbell that a part transferred rapidly from opertion to operation, without a cooling period between, will be inaccurately machined, because of temporary warping or expansion of the metal, due to heat. This contention has not proved true in actual practice. No such trouble developed, for example, in the Morris gearbox referred to above. Production can be as slow or as rapid as desired. Units can be grouped according to similarity of operations, such as drilling, milling, turning, etc., in line, or groups, or stations, or operations can be mixed according to the piece to be produced. The line can be broken when necessary, and banks of parts set aside for cooling.

In 1911, when I introduced the station principle, I was considered visionary, as Mr. Campbell suggests. But the plan is an accomplished fact in many places today, and the units are well on the way to become standard practice within the next few years. At least a dozen firms have started to sell them.

With units, a breakdown is not so serious as with standard machines. Spare units can be quickly placed in position, and, since the elements of the units are few and of standard design, repairs of the broken parts can be readily and cheaply made. Extra machine capacity can be provided, when required, by assembling an excess of units for any particular operation.

Mr. Campbell says, "In the event that operations were all hooked up, the down time on one machine would, of necessity, hold up all operations." But he forgets that this happens with standardized machine equipment, and the results are far more serious. The last time I was in the United States, while visiting a very large automotive plant, I discovered that the cylinder line was shut down. A machine for one of the key operations had broken down, and the whole line had been stopped, pending its replacement. Under the unit system, the replacement could have been made so quickly that it would not have been necessary to send the men home, and, with small banks of work-in-process in reserve, the line could have continued to operate with no interruption of production.

In conclusion, we may say that a continuous method of manufacturing is the system proposed, and standardized units are the mechanical elements necessary to its operation. The ultimate objective is to apply these continuous methods not only to machining processes, but also to all stages of production. The only breaks in the continuous line of production, from the initial handling of the raw material, to the delivery of the finished product, ready for shipment, would be those determined by technical considerations governing over-all efficiency, and not by the different processes in manufacture, as at present.

Exchanging Ideas

Discussion

By E. Andrews

Manchester, England

I AM heartily in accord with the views expressed in the editorial on page 596, Vol. 69, of the *American Machinist*. For the last twenty-five years I have been foreman of a railroad shop, and have been given an opportunity by the management to visit automobile, railroad, machine tool, and other machinery building plants to see new machine tools, modern welding equipment, and other labor saving devices. During these visits I have studied their equipment and operation with the viewpoint of obtaining the best results in our own shops by introducing effective production methods. It is needless to say that these visits have been most helpful to myself and in almost every case I have found manufacturers willing to extend the courtesy of showing me their plants and exchanging ideas.

Experience and observation proves that nearly every plant has some special labor-saving tools, devices, or improved methods of doing work, or handling material which can be successfully used by others, and it is only by exchanging ideas and utilizing those which are applicable, that we are able to make real and rapid progress in production manufacturing.

Sharpening Tungsten-Carbide Tools

CARBOLOY, Widia metal, and the other new high-speed cutting alloys, are now generally being furnished ground to shape for the tool required. They will stand up without resharpening for long periods of time if not overtaxed, but where it becomes necessary to sharpen them it can be done with a hard silicon-carbide wheel. One of the makers of grinding wheels recommends a No. 60 grain for this work. The wheel is used dry with a light pressure, and the tool kept moving to avoid grooving the wheel.

Torch Cutting in Railway Work

By Frank C. Hudson

Those shops in which the cutting torch is used as a production tool in place of rough machining operations find that considerable time is saved

OXYACETYLENE torches made their entrance into the railroad shop, as elsewhere, as a tool for patching broken parts, or for building up after an error in machining or after wear. They have been the "putting-on" tools of the shop for years and as such have played an important part in reducing costs in practically every important shop in the country. The torch has, however, literally carved out for itself an entirely new field in the railroad shop, that of cutting out any desired outline in valve motion links, forked arms, connecting rods, frame jaws and the like, as well as cutting boiler and firebox sheets to shape in amazingly quick time.

As with all new methods, it has encountered strenuous opposition in some quarters. Fears have been expressed as to its effect on the metal, it being felt that the high heat necessary for rapid cutting would be detrimental to the structure of the material and reduce its ability to withstand the shocks and other stresses to which locomotive parts are subjected. Opinions have differed widely as to its usefulness in this field. But the use of the method has grown gradually until cutting with a torch is now almost standard practice.

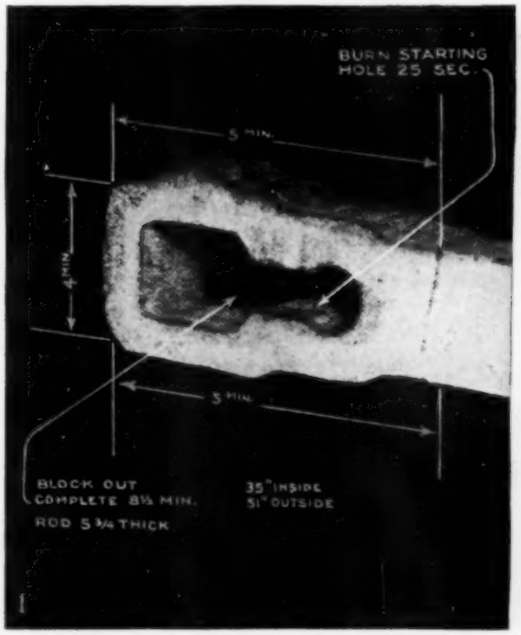
Cutting with oxyacetylene is based on the familiar fact that, above a red heat, iron combines with oxygen so rapidly that it actually burns. Steel, wrought and cast iron, and the various alloys of iron can be cut with oxygen. Theoretically, the heat generated by the hot iron burning with the aid of oxygen should be sufficient to heat the adjacent iron red hot and so continue to burn only with a jet of oxygen supplied where it was desired to cut the metal. In practice, however, this does not work out in exactly this way and additional heat is supplied by directing acetylene into the burning zone.

There seems to be no standard practice as to the amount of metal to be left for finishing after the burning operation. In some small frame work for mining locomotives, the jaws are cut almost to finished size, and are so smooth that they require very little machining. This shop does not find that the heavy plates used for side frames are injured by the cutting flame.

Some years ago, one of the locomotive builders made elaborate tests on the effect of the cutting flame on the metal. Samples were analyzed and micro-photographs made of the etched metal. It was then decided that a $\frac{1}{16}$ in. allowance was ample for removal of any metal that might have been overheated.

In most shops, however, there is an allowance of from $\frac{1}{4}$ to $\frac{1}{2}$ in. of metal for finishing the piece on the machine by milling or planing. It is also customary in many shops to anneal all pieces that have been cut with the torch. This, it is felt, relieves the pieces of all internal stresses that may have been set up in the metal from the high, localized heat at and near the line of the cut. Tests of the cut metals indicate that proper heat-treatment after cutting restores the metal to its original condition and that no fears need be felt as to its ability to stand up in service.

One of the advantages of torch cutting is the speed with which almost any shape can be outlined. No method of machining compares with cutting torch in this respect and it is much cheaper than attempting to forge close to shape, except, of course, such parts as can be made with dies in the forging machine or by a similar method.



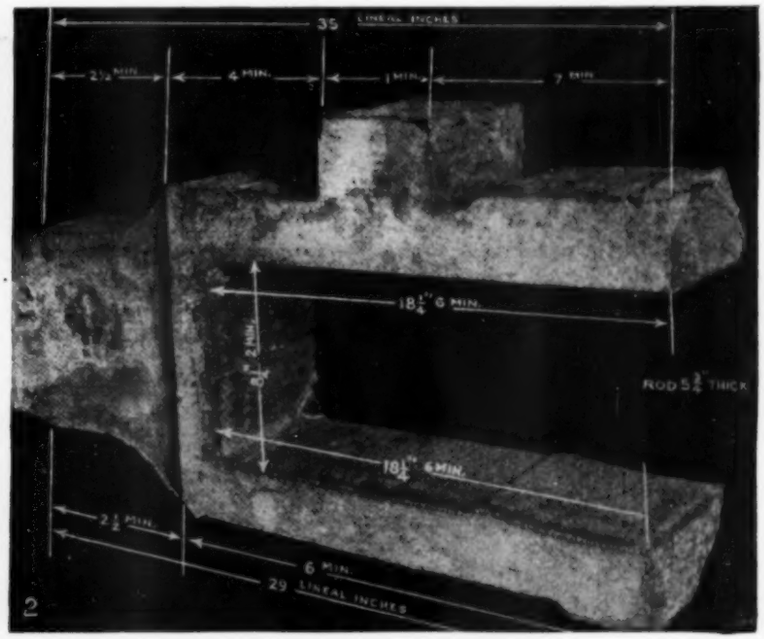


Fig. 1—Crosshead end of rod cut with torch. Fig. 2—Back end of main rod cut in same way

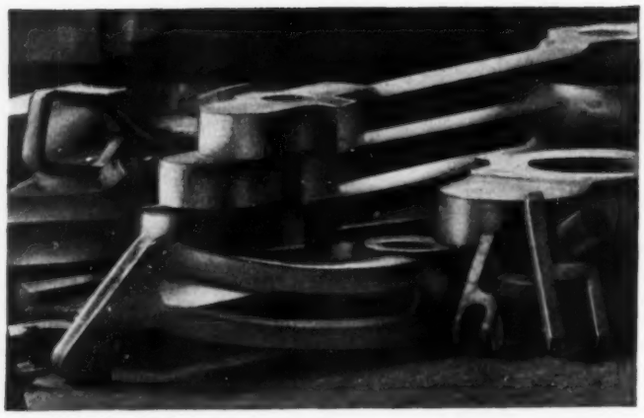


Fig. 3—Parts cut with a torch in a railroad shop

The following gives a general idea as to what can be done in average practice:

THICKNESS OF METAL IN INCHES	APPROXIMATE CUTTING SPEED IN INCHES PER MIN.	WIDTH AT KERF IN INCHES
$\frac{1}{2}$	16-18	$\frac{1}{8}$
1	12-14	$\frac{1}{8}$
2	9-10	$\frac{1}{8}$
5	6-7	$\frac{3}{16}$
10	3-4	$\frac{5}{16}$

These figures are conservative as compared with those obtained from several shops. One railroad shop for example reports cutting 2-in. steel at 15 in. per min., 4-in. at 10 in. per min. and 8-in. at 6 in. per minute.

Two examples of torch cutting are shown in Figs. 1 and 2, which illustrate both ends of a main rod. No starting hole was drilled in the crosshead end of the rod, the starting hole being made with the torch, through $5\frac{3}{4}$ in. of solid metal in 25 sec. The block was cut out in $8\frac{1}{2}$ min. more, a distance of 35 in., while the 51 in. of the outside was cut in 14 min. Detail times for the other cuts are shown in Fig. 2 and give a good idea of what can be accomplished with the torch in the hands of a first-class operator.

Using the cutting torch at the speeds mentioned, as a method of rough machining, saves time, and the cost of machine equipment is greatly reduced, since planers, shapers, slotters, or milling machines can be kept for the finishing operations. Furthermore, as the amount of metal to be removed is uniform, after the rough cutting of the torch, a greater average feed per minute can be secured in the machine used for finishing.

Further examples of torch cutting in railroad shops are seen in Fig. 3 which illustrates several rod ends and a link for a radial-motion valve gear. The clean cut surfaces are particularly noticeable. Figures of the time required by cutting as against machining show a saving of over 50 per cent. This includes the cost of acetylene, oxygen and labor.

The method of cutting out a side rod is shown in

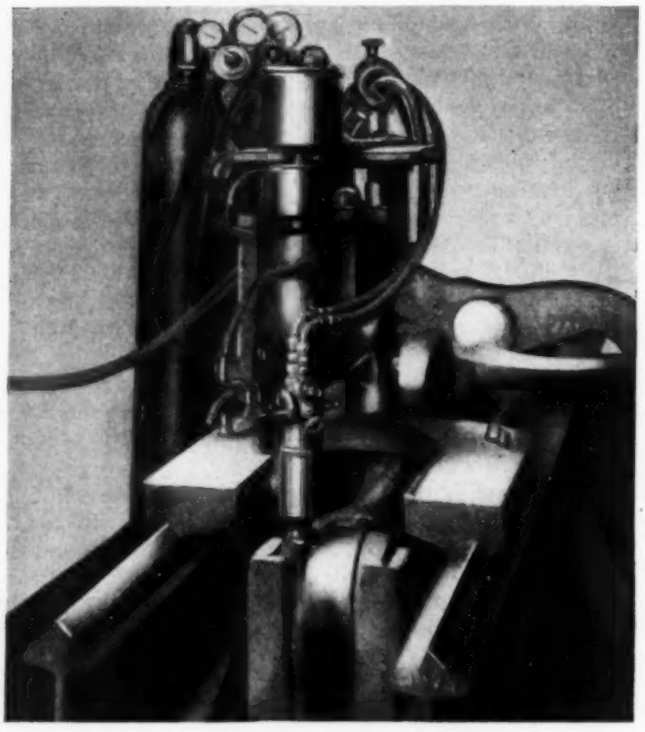


Fig. 5—Cam operated machine cutting forked end of lever

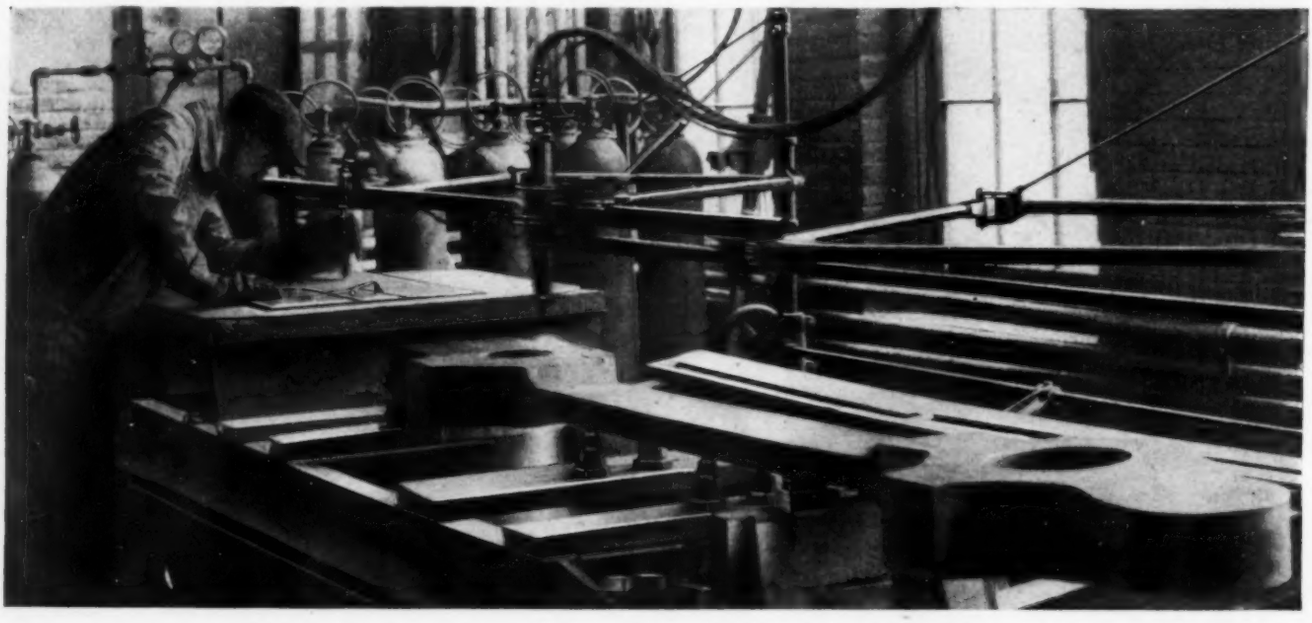


Fig. 4—The oxygraph cutting machine at work outlining a connecting rod

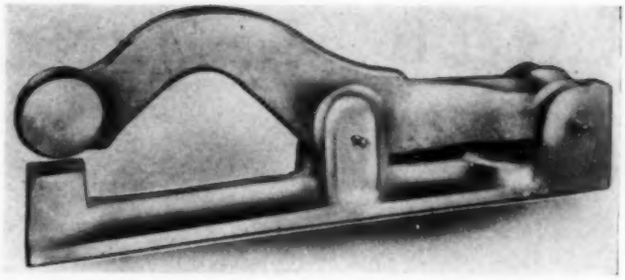


Fig. 6—Holding fixture in which arm is cut

Fig. 4. The torch is guided by the "Oxygraph." The operator moves the pointer over a suitable templet mounted on the table at the left. This illustration also shows how the rod is supported on short screw jacks on a frame built up of steel channels mounted on cast iron legs.

Another example of machine cutting is shown in Fig. 5, where the forked end of a Baker valve-gear arm is being cut on a "Camograph," so called because of the operating mechanism. A magnetized roller contacts with a cam surface and moves the torch over the work along a definite path. The method of holding the lever arm is shown in Fig. 6, the cast frame being removed from the machine to show the simple manner of clamping by means of set screws. In Fig. 5, the end of this frame shows under the torch.

Room for Improvement in Manufacturers' Catalogs

By John Cetrule

President, Triplex Machine Tool Company

According to our experience, one of the chief reasons for the increase in cost of selling machine tools is the fact that many manufacturers have very poor catalog material, poor price lists, and do not give enough information about their equipment. On the other hand, we have found that the buyers are not familiar enough with technical details and therefore put the responsibility entirely onto the seller to furnish the right equipment. Even formal inquiries seldom contain properly detailed information, so that the intelligent making of a quotation becomes doubly difficult.

As regards catalogs, personally we would like to see the machinery manufacturer adhere to the standard size of 8½x11 in. The catalogs should be in loose leaf form, contain plenty of pictures, and furnish all possible technical details and descriptions of the machines. Both outside and inside views of the various parts of the machines should be shown, including cross-sectional views as the last are particularly useful when repairs must be made.

Simplicity should be the keynote. It is often possible to use arrows pointing to the important parts to bring out the details of the machine. From a servicing angle also, it is most important to show photographs, properly numbered, of the principal parts for ease in ordering repairs. Standard accessories ought to be listed. In a lathe, for example, it is most convenient to know the standard chuck sizes that can be used on the machine. This sort of information is useful to both the seller and the user of the equipment. Similarly, the price list should be explanatory in detail.

Now if every manufacturer followed these suggestions there would be no need of useless correspondence back and forth between the buyer, the dealer and the manufacturer, and it would save everybody's time and take all mystery out of the equipment. Salesmen would also become more efficient, or at least they could be better held accountable for what they did not know. Furthermore, if the catalog and price list were complete, the buyer would not ask a lot of needless questions that the catalog could readily answer for him.

Machinery manufacturers may complain that to follow the above procedure of getting out high-grade catalog material would cost them a lot of money, but while it is true that good literature costs money, we find that it more than offsets the expense of having to send additional factory salesmen and service men around to rectify mistakes that would not have occurred or that could have been easily handled by the dealer's salesmen. Good catalogs are certainly cheaper when the cost of traveling of sales and service men is considered in this connection. Furthermore, in the initial sales work, it is much less expensive to have the catalogs present the chief facts than to have a salesman spend several hours explaining details to his prospects.

Apprentice Training
Discussion

By H. James

Birmingham, England

On page 816, Vol. 69, of the *American Machinist*, attention is drawn to the haphazard methods used by some firms in training apprentices, and the statement is made that those firms that do give their apprentices a thorough training are doing it for the benefit of other firms, as well as for themselves. This does not appear to be the case here, as those firms which give the best training usually employ the best class of labor and pay wages sufficient to attract it. Some firms, in fact, insist that apprentices gain at least two years' experience elsewhere after their 5-year training period, before recognizing them as skilled mechanics. In Birmingham some of the larger firms send their apprentices to a part-time course at the technical college. These courses last four years, and require attendance for six or seven hours during working periods and four hours in the evening, and they cover part of the ground of a degree course in engineering, thus allowing an ambitious student to work for a full university degree. Some firms make it possible for any of their apprentices who show ability by winning an award of sufficient high standard in an open competition, to take a full-time degree course, and even to do post-graduate work, requiring them, however, to sign an agreement by which they bind themselves to work for the firm for, say, three or five years allowing the period of study.

Production is largely a matter of knowing how to keep work moving through the plant. It is, of course, important to have the best machine equipment and skilled operators, but if the parts do not flow smoothly toward the final assembly and shipping department, there is disappointment both to customers and in getting the money back into the treasury. Finding what clogs the flow of material is a long step toward the answer to securing the desired production. And this is not so much a matter of knowing details of the particular product as it is of being familiar with the problems of production in general.

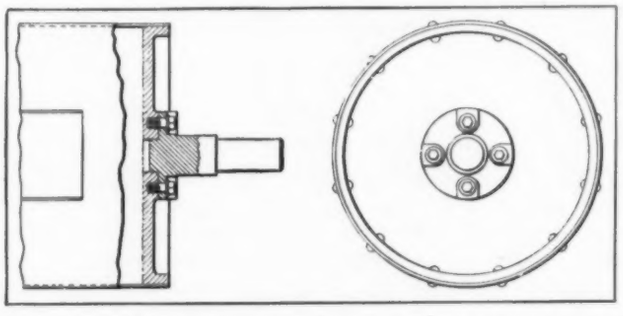
IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Repairing Tumbling Barrels

By Haye Maryland

For years tumbling barrels have been made with the journals integral with the ends, or heads. In a short time the dust and sand gets into the bearings and wears out the journals, making repairs necessary. To cut out the rivets holding the shells to the heads, make new heads and rivet the shells to them cost considerable, so the following method of making repairs was adopted:



Renewable journals for tumbling barrels

New heads having holes in the center were made and riveted to the shells after the old heads had been removed. Journals provided with pilots and flanges were made, as shown in the illustration.

The pilots fitted the holes in the heads, and the journals were attached by four capscrews, under the heads of which lock washers were placed. The tap holes in the heads and the clearance holes in the journal flanges were jig drilled. Duplicate journals were carried in stock, so that when those on the barrels wore out, it was necessary only to dismount the barrels, remove the worn journals and apply new ones.

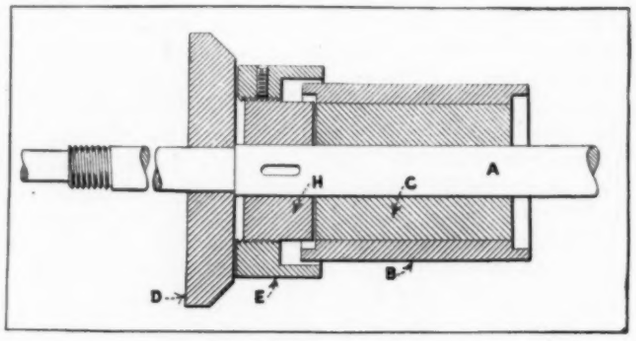
Improvement in Grinder Collars

By Edwin Kilburn

Grinders are frequently built without any efficient provision for taking up the end play in the wheel arbor. The illustration shows an adjustable, combination dust collar and wheel flange that enables the operator to easily take up all end play in the wheel arbor.

In the illustration, *A* represents the wheel arbor, *B* the bearing housing, *C* the bearing liner, *D* the wheel flange and *E* the dust collar. The dust collar is internally threaded and is mounted on collar *H*, which is threaded to fit it. Collar *H* is a sliding fit on the wheel arbor and is driven by a key. A headless setscrew, provided with a brass shoe, is used to lock parts *E* and *H* together.

Adjustment for end play is secured by loosening the



Improved collar for grinder arbor

setscrew and revolving the dust collar on collar *H*, thus bringing the dust collar against the wheel flange and collar *H* against the bearing liner and taking up all end play.

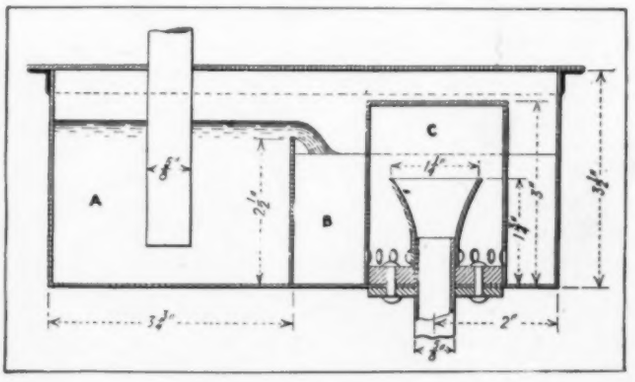
The wheel flange can be either a press or a shrink fit on the arbor, and the opposite flange may be made integral with its dust collar, or it may be made as shown in the illustration.

A Strainer for Cutting Compound

By V. Tatarinoff

Czecho-Slovakia

Devices fitted to metal-working machines for straining the cutting compound so as to prevent large chips and particles of sludge from getting into the pump and clogging it, are not always able to keep out the small,



Strainer for cutting compound

light particles that float on the surface of the compound. Such particles are apt to become incrusted on the inside of the pipe and even on the working parts of the pump.

To obviate these troubles, we designed the strainer shown in the illustration. It has been thoroughly tested in our works and has worked successfully. The dimen-

sions of the tank are suitable for a machine requiring cutting compound to be supplied to its tools at the rate of 1 gal. per minute.

The main feature of the device is a protecting drum that covers the entrance orifice of the suction pipe, thus preventing light substances floating on the compound from getting into the pipe, and through it to the pump. The tank is divided into two compartments by a bulkhead. Used compound flows into compartment *A* from the pan of the machine, the large chips and heavy sediment sinking to the bottom, while the light impurities float on the top. When this compartment is full, the floating particles pass over the bulkhead and into the compartment *B*, where they adhere to the outside of the funnel-shaped opening of the suction pipe. The protecting drum *C* has a series of holes near the bottom, through which the compound, but not the floating particles, pass to the suction pipe. Close to the top of the protecting drum, well above the surface of the compound, is a small air hole to prevent the formation of an air lock.

It will be understood that as long as the level of the compound does not get down to the holes in the protecting drum, floating particles cannot enter the drum and so reach the suction pipe.

Magnetic Chuck With Built-In Sine-Bar

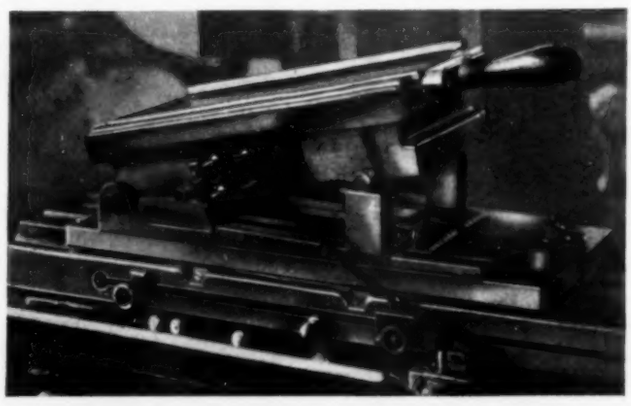
By Matthew Harris

In grinding angular pieces held on a magnetic chuck, angular blocks that can be magnetized through the chuck are required, or else the chuck must be capable of angular adjustment. An adjustable magnetic chuck with a built-in sine-bar, in use in the works of the Pratt & Whitney Company, is shown in the illustration.

The chuck is pivoted at one end and the other end is provided with hardened and ground pins, one at each side. The pivot pin and the hardened and ground pins are of the same diameter, and their distance between centers is 10 in., thus making of the chuck virtually a 10-in. sine-bar.

In setting the chuck to the required angle, gage blocks, either single or in combination, are placed under the pins at the end of the chuck and rest on hardened blocks let into the base of the chuck. The pins are so located that when no gage blocks are under them and they rest on the hardened blocks in the base, the chuck is at an angle of 6 deg., being lowest at the right-hand end.

It will be understood that to bring the chuck level, gage blocks of a height equal to ten times the sine of 6 deg. must be placed under the pins. In setting the chuck to any desired angle, 6 deg. must be added to that angle in taking the sine. The weight of the chuck is great enough to hold it down on the gage blocks while the grinding is being done, so that no clamping is necessary.



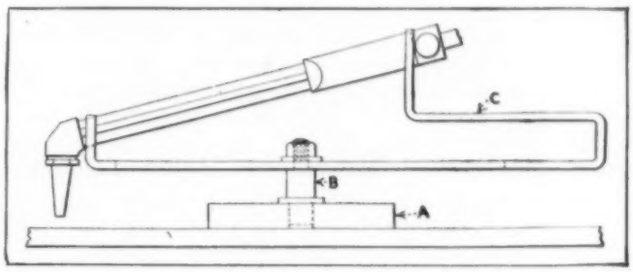
Sine-bar built into a magnetic chuck

Circular Attachment for a Cutting Torch

By Ralph N. Stryker

In the illustration is shown an attachment for a cutting torch by means of which circular pieces having a diameter of 10 in. or more can be cut out of sheets.

The attachment consists of the disk *A*, in which the pivot pin *B* can be revolved, and the cradle *C* for holding the torch. The disk is about 9 in. in diameter and acts as a base for the cradle, being heavy enough to keep it from tipping. The torch lies in the cradle, as shown, and



Attachment for a cutting torch

is prevented from slipping down the incline by the valve handle, which abuts one of the wings of a crotch cut in the upper member of the cradle. The lower member of the cradle is slotted so that it can be slid along the pivot pin, bringing the torch nozzle nearer to or farther from the center.

After the cradle has been adjusted to bring the torch nozzle to the desired radius, it can be locked by the nut at the top of the pivot pin. In operation, the torch nozzle is made to describe a circle by rotating the cradle.

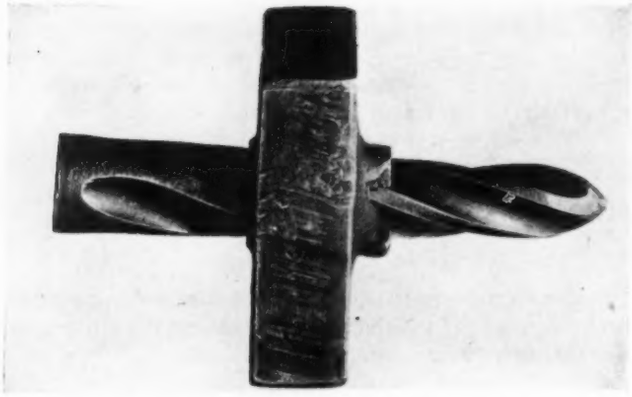
Splining Holes with Explosives

By R. E. Marks

As a result of experience gained during the war, explosives are being utilized to pierce metal in a variety of ways. One adaptation of the projectile principal is to drive a steel pin through several thicknesses of steel plate, the legs of steel angles, the webs of I-beams, or any other combination used in structures of any kind. This method of pinning parts in position preparatory to welding, has some advantages over the usual punching, or drilling, and bolting. All that is necessary is to put the parts in the positions desired and shoot the pin through them with a special gun.

A different application is shown in the accompanying illustration, where a spiral-fluted pin has been driven through a plate about $\frac{3}{4}$ in. in thickness. When the pin was backed out the hole was as perfectly splined as though broached, and it is said that the fluted pin could be straight as well as taper. The bulge, or extrusion of metal, around the hole can be largely avoided by supporting the plate being punched on the back side.

The surface of the metal in the hole is very smooth



Shooting a soft steel spiral fluted pin through a sheet of steel without distorting the pin

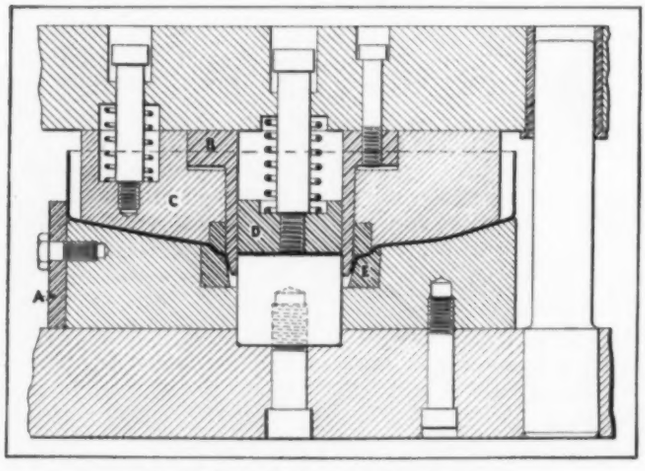
and compact, burnished in fact, and evidently very dense from the compression that takes place as the particles are forced out, at right angles to the hole, as the punch goes through. It should make a good wearing surface.

While the illustration resembles tests made of specially tough steels some years ago, when cold chisels were forced through blocks of steel, the action is entirely different. The chisels illustrated the toughness and high quality of the steel of which they were made. In this case, however, the pin or projectile is not hard but soft, and is forced through without deformation, due to the high velocity with which it is propelled by the explosive in the gun.

Piercing, Forming and Extruding Die

By Ernest Foldvary

The die shown in the illustration is for piercing, forming and extruding the neck of a tank cover. After the cover has been blanked and drawn, it is placed in the die, being located by three locating blocks, as at *A*. The piercing die *B* descends with the ram and, in connection



Combination die for a tank cover

with the piercing punch, pierces the outlet hole in the neck. It also starts the extrusion. At the same time, the forming punch *C* starts to form the circular rib around the neck, through spring pressure. When the resistance of the metal is greater than can be overcome by the springs, the punch holder and the forming punch come into contact and move as one unit. Further downward movement of the press ram causes these two members to finish extruding the neck and to complete the circular stiffening-rib around it.

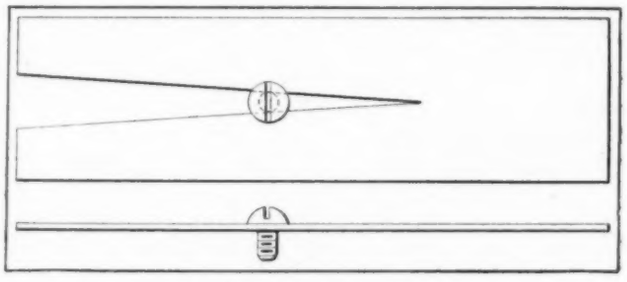
Upon the return stroke of the ram, the forming punch acts as a stripper for the cover, and the stripper *D* pushes the slug out of the piercing die. To prevent the edge of the neck from cracking at *E*, it is necessary to anneal the spot where extrusion takes place, before performing the operation described. Annealing is done with a torch, heating the spot to a bright red. Annealing equalizes the strains in the metal and permits the extrusion of the neck without leaving a rough and uneven edge.

A Holder for Short Screws

By Morton Schwam

In assembling parts with small, short screws, many a mechanic's "fingers are all thumbs." If the screws are dropped, time is lost in hunting them or in going after new ones.

A very convenient device in which short-length screws can be held while being started into tapped holes, is shown in the illustration. The holder is easily made by cutting a V-shaped slit in a rectangular piece of thin-gage sheet steel. In assembling a part with short screws,



Holder for short screws

a screw is placed in the slit in the holder where the head is supported by the upper face. The screw stays in the holder until after it has been started into place by a screwdriver. The holder is then removed and the screw can be driven home.

Gear Cutting on a Shaper
Discussion

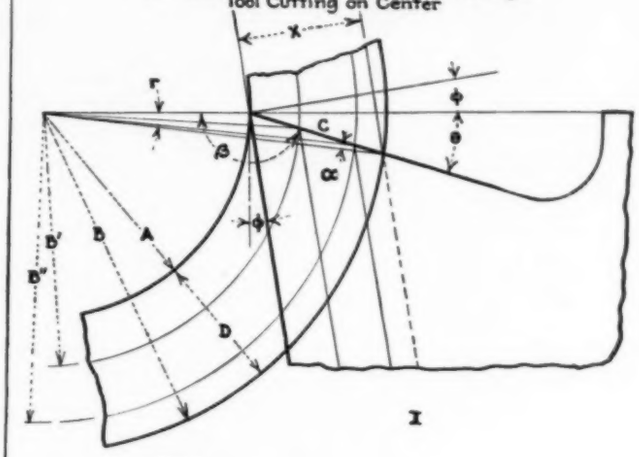
By Charles Kugler

The article on page 31, Vol. 70, of the *American Machinist* is of interest to me because I have done similar work. The author says: "If a new gear is to be cut, the best thing to do is to secure a duplicate gear and press it and the blank on the same mandrel, and index by a stop-pin or any other convenient method."

I fail to see why he did not use this method when he had the teeth in the gear he was repairing, to index from. I would have done the job as follows: Color the tool with copper sulphate, place it against the side of the gear and scribe the contour of the space between two teeth. I would then finish and harden it. I would next press the gear on a mandrel, clamp it in the shaper vise and rough it out, using a stop pin for indexing. I would then use the finishing tool, indexing as before from the remaining gear teeth.

Corrections for Circular and Flat Form Tools

Corrections in Tool Profile
Flat Tool With Top Rake and Clearance Angles
Tool Cutting on Center



I

Given
ϕ = Tool clearance Angle
θ = Tool top rake angle
$\beta = 180° - \theta$
2A = Small diameter work - A = radius
2B = Large diameter work - B = radius
D = Step on work = B - A

Calculation

$$\sin\alpha = \frac{A \sin\beta}{B} \qquad [\sin(180° - \text{Angle}) = \sin \text{angle}]$$

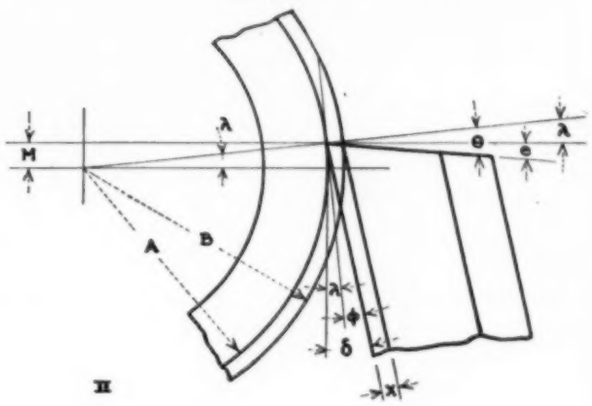
$$r = 180° - (\alpha + \beta)$$

$$c = \frac{B \sin\gamma}{\sin\beta}$$

$$X = C\cos(\theta + \phi)$$

B' and B" denote intermediate steps on work and should be used for B in calculating corresponding correction

Corrections in Tool Profile
Tool Cutting Above or Below Center
Flat Tool



II

Given
A and B same as on chart I
M = Distance above or below center
δ = Tool clearance angle
e = Tool top rake angle

Calculations

Cutting point above center	Cutting point below center
$\sin\lambda = \frac{M}{A}$	$\sin\lambda = \frac{M}{A}$
$\phi = \delta - \lambda$	$\phi = \delta + \lambda$
$\theta = \lambda + e$	$\theta = \lambda - e(-)$ or $e - \lambda(+)$
$\beta = 180° - \theta$	$\beta = 180° + \theta$

Substitute these values in formula under "Calculation" on chart I and solve for "X" as usual. λ must be less than δ or tool will not cut

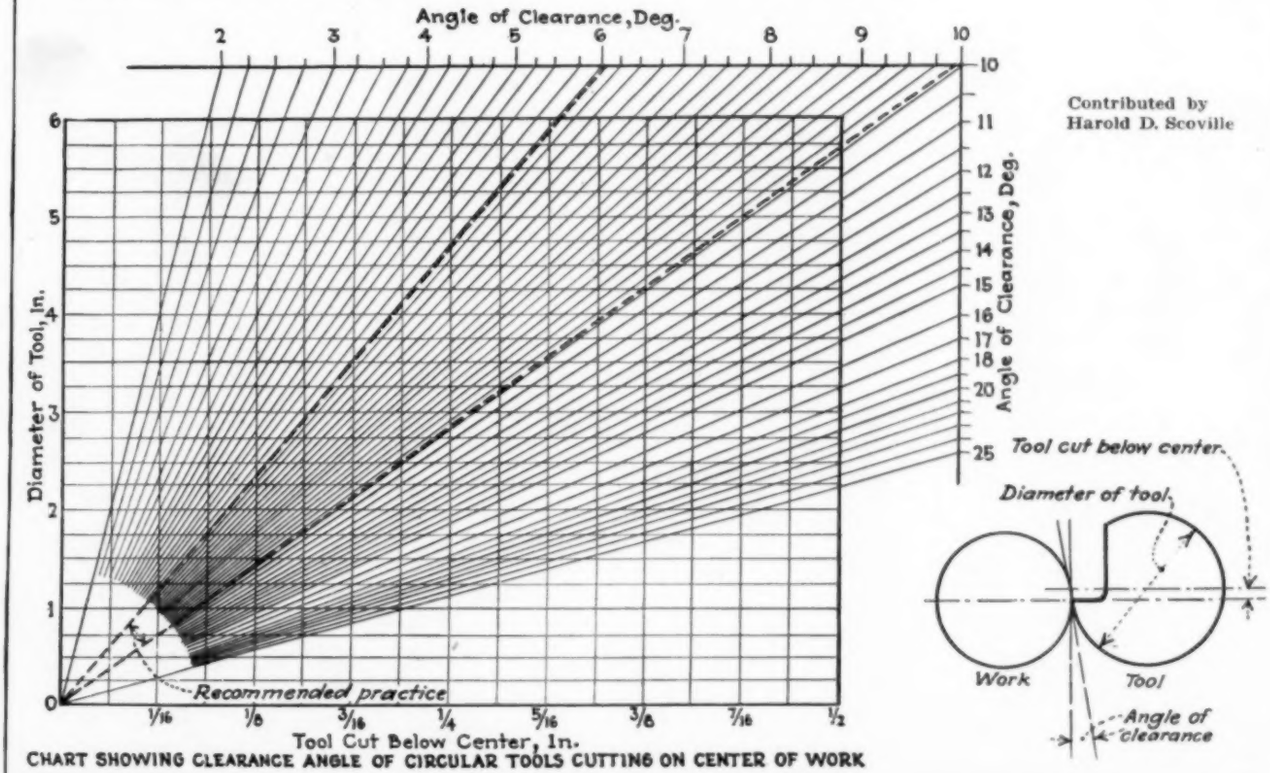


CHART SHOWING CLEARANCE ANGLE OF CIRCULAR TOOLS CUTTING ON CENTER OF WORK

Contributed by
Harold D. Scoville

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Firm Purchasing

MORE than a few of the most astute purchasing agents in this country have adopted the practice of insisting that each salesman interested in a given transaction submit one and only one bid. In other words, he must put in his best price first—he has no second chance.

There is small doubt that these purchasing agents sometimes pay a little more than they would under the old haggling system, but their answer is that they simply cannot afford the time required to conduct such negotiations. They are busy men and they consider it more efficient to save money by eliminating the time and effort wasted in discussing two or more bids from a number of salesmen than by beating these same salesmen down.

Such an attitude is iconoclastic to say the least. No longer can the high pressure go-getter advance to the attack with fire in his eye, determined to batter down the purchaser's defenses at all costs, even profit. Nor can his smooth and adroit competitor clear the way with theater tickets, liquid refreshment, or more substantial gifts. Each has one opportunity to put in a bid at what he considers to be his best price, and then he is through.

Obviously, a lot of the fun of selling will disappear if this practice becomes general. The speculative interest involved in calculating how much to pad the first bid so that it can be pared later will evaporate, and the satisfaction of outguessing a hard-boiled buyer by cutting less than is really possible will be no more. On the contrary, the danger of cutting too much, and of securing business at little or no profit will be eliminated, and that will be a very real benefit.

Importance of a Knowledge of Materials

IT IS both notable and praiseworthy that more attention is being paid to the materials used in constructing machines than formerly. True, we have many more materials from which to choose, which perhaps makes it more difficult to decide on the best, but at the same time easier to secure a material suited to our needs. The designer no longer merely says "make this of cast-iron," he specifies what qualities or characteristics the iron must have. He no longer says "machine steel" or "tool steel," as the case may be, he designates the strength and other qualities it must possess.

A knowledge of materials often makes possible savings that might otherwise be neglected. If, for example, a steel of certain characteristics is priced too high, it may often be possible to find a steel differently alloyed that will serve all the requirements at a lower price. Materials that work well under some conditions may have grave defects under others. In all branches of industry the man who knows the materials that enter into his work is in a much stronger position than the one without such knowledge. Every purchasing agent might well have an engineer with whom he can consult regarding purchases of materials.

Paying Students to Go to College

CHARGING a tuition fee that is somewhere near the cost of the tuition given is no new thought to those interested in higher education, either from the standpoint of the college trustee or from that of the employer of the graduate. But it has remained for the new president of Stevens Institute of Technology, Dr. Harvey N. Davis, to propose a plan in which he has sufficient faith to put it into effect experimentally.

Briefly, what he proposes is to charge six hundred dollars a year for tuition that costs the Institute nine hundred. The present rate is four hundred dollars. The better men in the class will be able to cut down the cost of their education materially by attaining high scholastic standing, earning part of their expenses at approved jobs, and leading in various extra-curriculum activities, athletic or otherwise Points will be given for these various achievements, points that can be transformed into remission of tuition.

Dr. Davis maintains that it is better to pay a boy for doing well the things he was sent to college to do than to require him to earn his way, if that be necessary, by tending furnaces, selling papers or running laundry routes. Thoughtful employers will agree with him. Most of them, other things being equal, would rather hire the graduate who has had to earn at least a part of his own way.

On the other hand, if points are given for elective offices it may very well be that student politics will take on a color closely related to that of ward politics and thus present a new worry to the college authorities. Even so, the plan is emphatically worth trying. If any measure of success attends the experiment the plan is due for wide adoption.

Potter & Johnston No. 4-D Automatic Chucking and Turning Machine

BASED on the design of the No. 5-A model, the No. 4-D automatic chucking and turning machine has been placed on the market by the Potter & Johnston Machine Company, Pawtucket, R. I. The "Power-Flex" 5-D machine, having many of its features was described on page 909, Vol. 66, of the *American Machinist*. Among the features of the 4-D are the heavy-duty shafts and gearing made of chrome-nickel steel and the wide turret slide and bed ways, each their depth $3\frac{3}{8}$ in. The distance from the center of the turret hole to the top of the turret slide is $2\frac{3}{4}$ in. The maximum travel of the turret slide, exclusive of $2\frac{1}{2}$ in. for revolving it, is $9\frac{1}{8}$ in., and the length of the turret slide travel, which permits of supporting or piloting turret boring or turning tools, is $4\frac{1}{4}$ in. A hole $1\frac{9}{16}$ in. in diameter is provided through the spindle. The swing over the bed is 21 in. and the swing over the cross-slide is $9\frac{3}{4}$ in. The turning limit for a standard turning tool is 9 inches.

Change gears give spindle speeds ranging from 24 to 335 r.p.m. Standard feed change gears give feeds per revolution of the spindle from 0.004 to 0.047 in., and the auxiliary reaming and threading attachment gives feeds per revolution from 0.050 to 0.121 in. From 5 to $7\frac{1}{2}$ hp. is required to drive the machine, which is arranged for single-pulley drive, but which may have a motor fitted on a base at the rear of the headstock. A constant-speed motor is recommended.

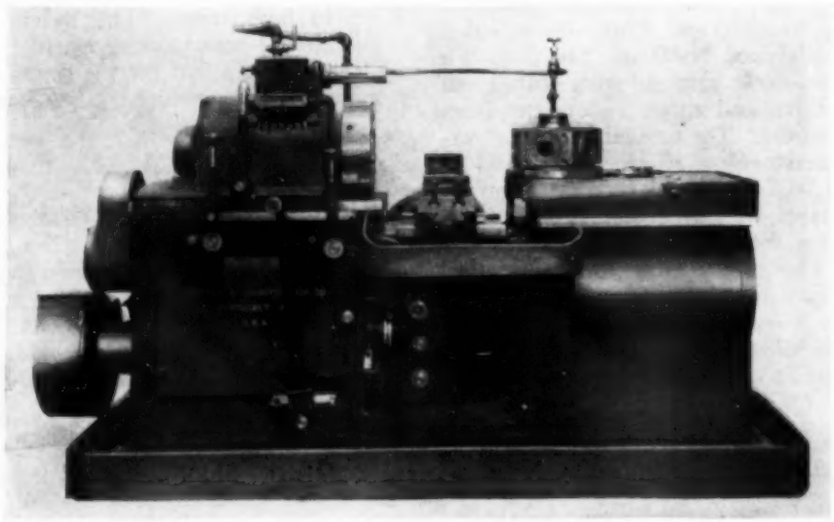


Fig. 1—Operating side of the Potter & Johnston No. 4-D Automatic Chucking and Turning Machine

provided with hardened and ground steel inserts. All principle points in the base are lubricated by a positive-pressure lubricating system and other units by means of a splash system.

Timken tapered roller bearings are used for the spindle, which is driven through herringbone gearing, and all intermediate feed shafts are mounted on ball bearings. Power is transmitted through multiple-disk speed clutches. The cross-slide of the unit type is operated by means of an integral cam drum, the travel of the cross-slide each way being $3\frac{1}{4}$ in. The conventional type of overhead support arm has been eliminated from the large turret, and an automatic binding device is provided instead. The turret has five faces, the holes in the faces being 2 in. in diam., and

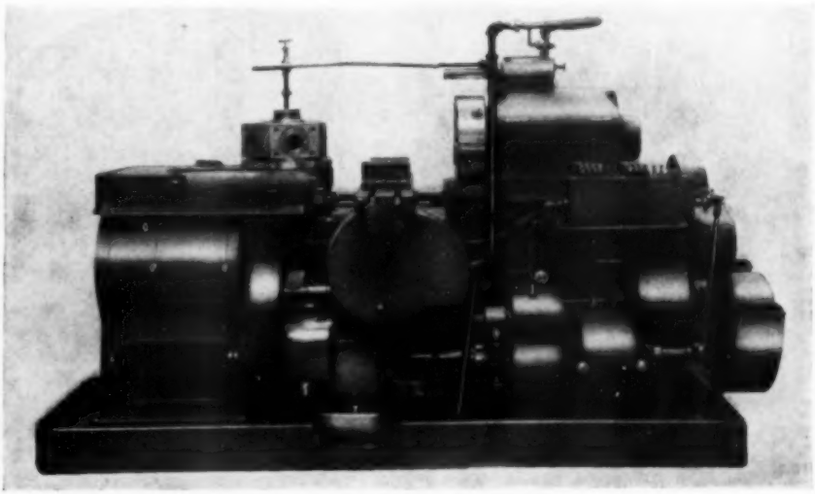


Fig. 2—Rear view of the No. 4-D showing the positive-pressure lubricating system and the unit-type cross-slide

"Ammco" Drill Press Vise

A feature of the "Ammco" drill press vise announced by the Automotive Maintenance Machinery Company, 816 West Washington Boulevard, Chicago, Ill., is the V-shaped slot in the movable jaw, which affords positive clamping of vertical work. The swivel handle of the tool makes the vise easy to use, and it can be swung outward or back out of the way when necessary. The jaws are $3\frac{1}{2}$ in. wide, $1\frac{1}{2}$ in. deep, and they open $4\frac{1}{2}$ in. They are machined all over and grip the work positively.

"Ammco" Drill Press Vise

"Rigidmil" Vertical Reciprocating- and Rotary-Table Milling Machines

EXTENSION of the standard line of No. 3 "Rigidmil" milling machines has been made by the recent development of an improved rotary table and an improved vertical spindle head, both of which can be placed on the standard bed and column. With these additions, the standard line of No. 3 machines, manufactured by the Sundstrand Machine Tool Company, Rockford, Ill., comprises four machines, horizontal and vertical rotary units and horizontal and vertical reciprocating models. An earlier form of the rotary table and of a vertical spindle-head attachment were described on page 696, Vol. 64, of the *American Machinist*.

Base, column, and saddle of the No. 3 Rigidmil are combined in one casting. A reservoir for cutting compound is contained in the base. The vertical spindle head shown in both Figs. 1 and 2 is mounted on the column in place of the horizontal head described on page 901, Vol. 61, of the *American Machinist*. Driving power for the vertical cutter spindle comes from a shaft which drives the horizontal head, is transmitted to a horizontal shaft, thence to a pair of pick-off gears, and finally through a worm and wormwheel combination to the spindle, which is of the national standard type. The spindle head has wide supports and a narrow guide, the vertical adjustment of the spindle being 10½ in. Standard spindle speeds range from 12 to 648 r.p.m. for both the reciprocating and rotary types, but with the addition of the pick-off gears mentioned above, a speed range from 9 to 925 r.p.m. is available. Smooth cutting is insured by a heavy flywheel mounted on the spindle.

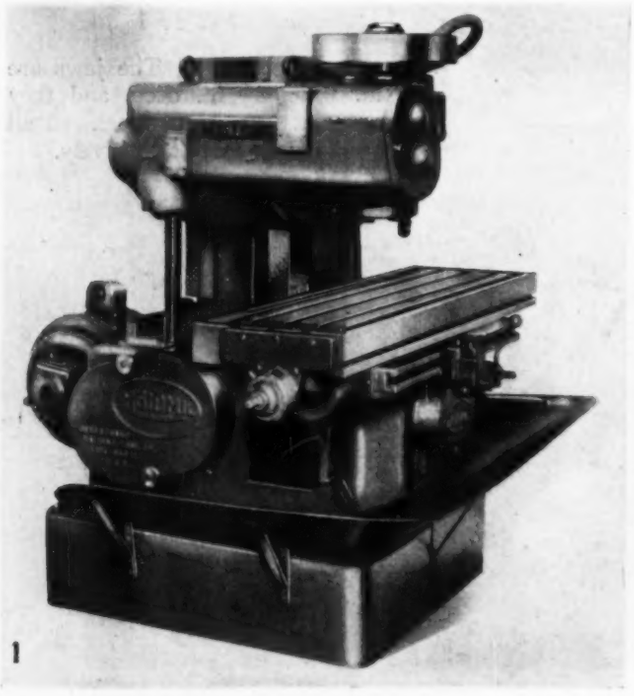
Reciprocating tables are available in 28-, 34-, and 42-in. feeds and a special feed of 60 in. The table is a semi-steel casting with cored oil pockets and three T-slots cut from the solid. The standard working surface is 14½ x 50 in. with a feed of 28 in. The rapid traverse is at the rate of 102 in. per min. Table feeds range from 1.9 to 21.4 inches.

The rotary table for the vertical rotary milling machine is mounted directly on the saddle without intervening sliding members. The rotating portion is 17 in. in diam. and its top is 33¾ in. from the floor, or 1¾ in. higher than the standard table height of 32 in. The table is driven by a worm, which meshes with a wormwheel cut at the lower end of the table. The base is heavily ribbed, is channeled to give ample space for chips and cutting compound, and has 16 in. of longitudinal adjustment. Fixtures up to 22 in. in diam. may be used in connection with the standard vertical spindle head. Still larger fixtures may be used in some instances, when a special offset spindle head is provided.

Both spindle bearings for the vertical spindle head are of the Timken tapered roller bearing design. Motors from 5 to 7½ hp. and running at 1,200 r.p.m. are required for either type of milling machine. The total height is 58 in. in both cases. The weight of the vertical reciprocating machine is 4,600 lb., while that for the rotary machine is 4,500 pounds.

Frew No. 2 Duplex Hand Miller

Milling parallel faces on opposite sides of the work with hand feed is possible on the No. 2 duplex hand miller announced by the Frew Machine Company, 124 West Venango



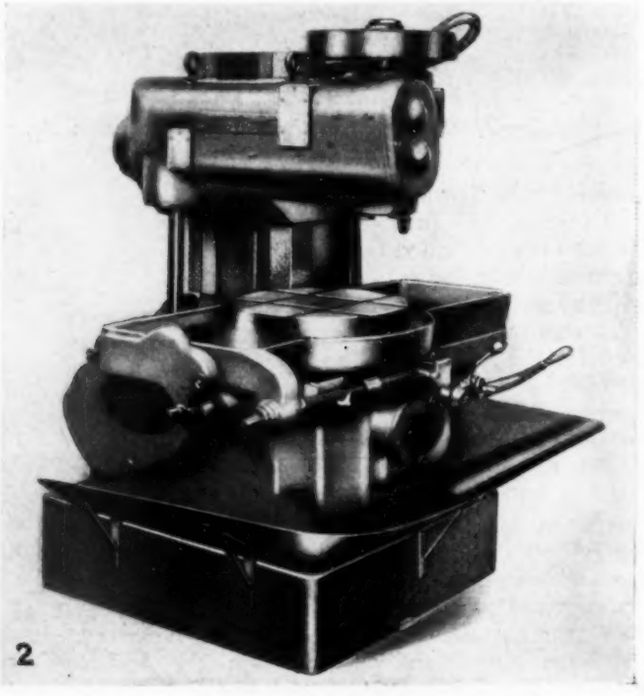
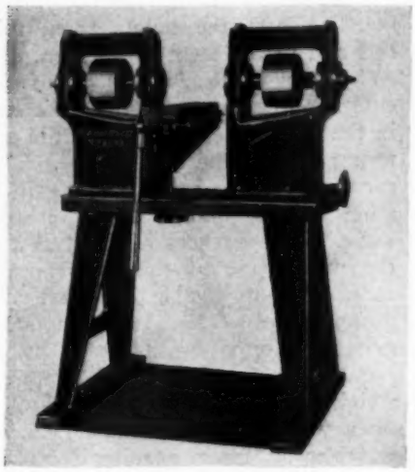


Fig. 1—"Rigidmil" No. 3 Reciprocating-Table Milling Machine. Fig. 2—Milling machine of the same unit design equipped with a rotary table instead of the reciprocating type



Frew No. 2 Duplex Hand Miller

St., Philadelphia, Pa. According to the manufacturer, this machine is particularly adapted for economical and rapid manufacturing of small standard articles on which both sides must be finished at once and parallel. The machine illustrated is for single-pulley drive and can also be furnished with cone pulleys. If desired, the fixed column can be bored at the top for an overload arm in case only one cutter is to be used and it is desired to support it at the other end.

The machine consists of two columns mounted on a heavy bed, one column being stationary and the other one movable. The stationary column carries the knee, saddle, and table. The table, which is $16\frac{1}{4}$x$4\frac{5}{8}$ in., is moved by means of a hand lever and gear meshing with a rack. Maximum movement of the table with the hand lever is 4 in. In and out movement of the table is by means of a screw.

The vertical movement of the knee in the machine illustrated is by means of a handwheel placed underneath the bed within easy reach. Lever feed to the knee can also be furnished, the movement being accomplished by means of a rack and pinion. However, on account of the small space available, it is not possible to get very much movement by means of this lever. The movable column is adjusted by means of a handwheel at the end of the bed, the base of the column being tongued and fitting in a groove in the table. Adjustment in line with the spindle is $1\frac{7}{8}$ in. Bolts in slotted holes in the side of the column are used to lock it in the desired position.

The spindles are of alloy steel, and are carried in Timken tapered roller bearings. The taper hole is No. 7 B & S, and the minimum distance between the spindle ends is $6\frac{3}{8}$ in., the maximum being 10 in. Height from the floor to the spindle center is $42\frac{1}{2}$ in. Floor space required is 36x20 inches.

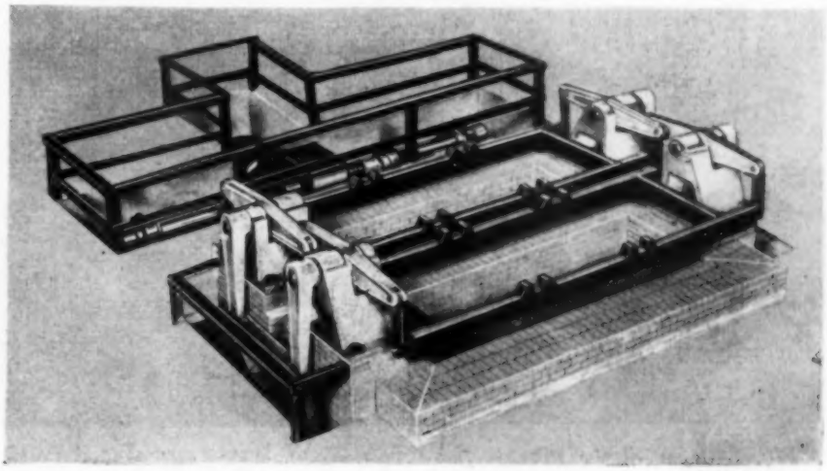
Nukem Suspended-Frame Pickler

RAPID and economical pickling of sheet metal and cast metal products with low upkeep while maintaining clean, dry surroundings can be obtained by the use of the suspended-frame pickler developed by the Nukem Products Corporation, 70 Niagara St., Buffalo, N. Y. Brick tanks, bonded with "Basolit" manufactured by the above company, are used for the process, and they are protected from injury by means of the frame. Only a slight space is left around the tank for the operation of the connecting links, and these spaces are connected to drains so that they may be kept clean. Loads of parts or sheet metal weighing up to 5,000 lb. are placed on the frame by means of cranes and by the same means are transferred from the acid bath to the water rinsing tank.

The illustration shows a typical arrangement for pickling flat sheets. It consists of two tanks, set side by side, or one tank with a partition. A skeleton frame is suspended above each by links attached to the ends of the levers. The frames have openings the size of the inside of the tank through which the load of material is lowered. The commonly-used rack or crate is suitable for sheets. These racks have chains or links attached which can be readily hooked to a crane carrier. The only special requirement for this pickler is to have the ends of the carrier project a few inches so as to rest on the frame of the machine.

When the overhead crane drops a load into the tank, the projecting ends of the carrier come to rest on the frame, after which the crane hook is disconnected. The motor, placed in a T-shaped inclosure at the rear of the tanks, is started and the crate moves up and down through the solution, thus washing the work. The load does not swing or sway, but the action of the water, due to the movement, gently separates the sheets or parts so that the solution reaches every portion. As the frame over one tank moves upward, the other frame moves downward, and thus a balance is obtained. The only time it is necessary to stop the machine is when a load is to be removed or a new load placed in the tank. However, a single load may be handled, although this requires more power because of the unbalance existing.

Movement of the frame levers is accomplished by means of motor-driven shafts, parallel with the tanks, but outside of them. The motor is connected direct to a worm gear speed reducer. Shafts leading from the speed reducer are connected with flexible couplings and a crank arm is connected at the extreme end of each shaft. Connecting rods join the cranks to the arms connected to the



Nukem Suspended-Frame Pickler

lever shafts. All important moving parts have roller bearings and every part is designed for heavy service. The blocks carrying the levers are of heavy cast iron, while the steel frame of standard equipment is built for a load of 5 tons. The carrier frames are also made of steel. All metal within reach of the acid is coated with aluminum bronze to prevent corrosion.

The tanks used in the standard installation are 4 ft. 8 in. wide, 6 ft. deep, and 13 ft. long, all inside dimensions. The extreme width of the pickler is 23½ ft. and the extreme length is 28 ft. Standard installations require a 10-hp. motor.

Putnam Billet Peeler

LARGE tonnages per day of round unstraightened billets can be turned down rapidly to a uniform depth on the Putnam billet peeler. The machine illustrated will handle billets up to 12 ft. in length and from 3½ to 12 in. in diam. and produce 13,000 lineal ft. of the former size and 3,700 lineal ft. of the latter size in 24 hours, the tonnage being 210 and 700, respectively. For all billet sizes the cutting speed is maintained at 40 ft. per min., the revolutions of the cutter head being adjusted to obtain it. The cut taken is ⅛ in. deep, reducing the diameter ¼ in., so that practically all of the surface defects are removed. The machined surface is smooth and of such a texture that any remaining defects may be detected by a visual examination.

To obtain a uniform depth of the cut, the camber of the billet is followed so that the centers of gravity of the rough section and of the finished section coincide approximately. This billet peeler has been placed on the market by the Shaw-Crane-Putnam Machine Works, Inc., Div. of Manning, Maxwell & Moore, Inc., Fitchburg, Mass. In Fig. 1 a view of the right end or discharge side is given.

Billets are placed on the entering bed or skidway at the left-hand end of the machine by means of the three-motor crane furnished with the apparatus. The entering bed, however, must be furnished by the customer. The crane is also used for lifting the toolholders in and out of the machine. A small crane over the machine lifts the billets from this bed and places them in position, one end resting in the lower jaws of the entering side grip and the other end in the adjustable V-block, on the entering side of the cutter head. The carriage for the entering side grip is a massive steel casting sliding on steel ways. The surfaces of the bed and the under side of the carriage are faced with renewable hardened and ground steel plates. An automatic gripping device or chuck is incorporated in the design. A counterweighted, hinged member operated by a wedge and pneumatic cylinder provides an ample opening for placing billets in the chuck. The three jaws of the chuck slide in tapered pockets in the adapter plates, so that as the torque increases in the billet, the jaws slide up the taper and the grip is increased proportionately. The opening and closing of the chuck is controlled by one air valve, placed in a convenient position.

The discharge side grip is located at the right hand side of the cutter head. With the grip shown it is necessary to stop the cutter head and release the entering grip before closing the discharge side grip on the billet. On machines to be built in the future, however, a universal dis-

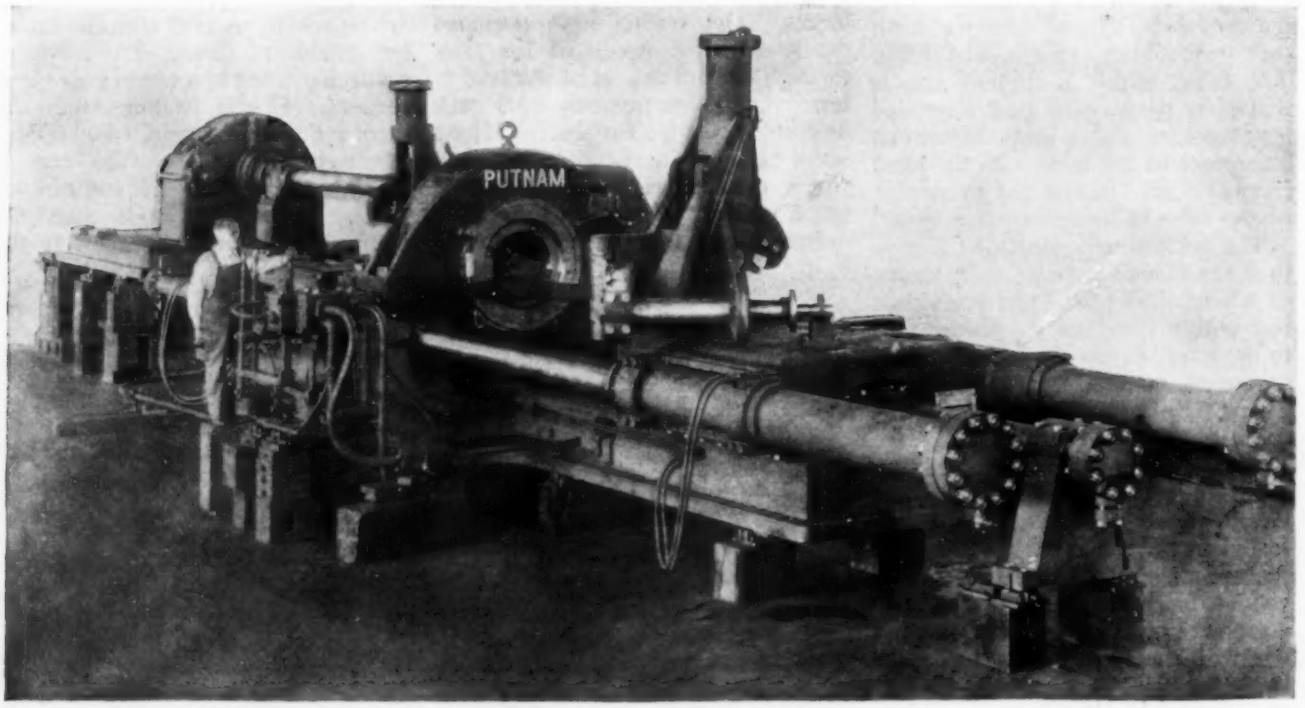


Fig. 1—View of the Putnam Billet Peeler with right-hand end or discharge carriage in the foreground. Billets enter the machine on the left-hand carriage, pass through the cutter head, and are discharged at the rear at the right

charge side grip is to be furnished. In this construction the lower jaw member is actuated by a small air cylinder and is normally in its lower, or outer, position, well clear of the billet as it emerges from the cutter head. When the air valve is opened, this lower jaw member first runs back into contact with the billet and then the hinged member containing the two upper jaws descends. As the jaws are mounted on a circular adapter plate, this plate will revolve in its seat until both upper jaws are in contact with the work. It is evident then that this type of grip will find and clamp the billet in whatever position it may be in due to its out of straightness or camber. It is not necessary to stop the cutter head and release the entering side grip before closing the discharge side grip. Operation of the machine will, therefore, be continuous.

Fig. 2—Close-up of a cutter head showing the six 3x2-in. tools in position

The machine is fitted with a central cutter head shown in a close-up view in Fig. 2. The entire toolholder assembly is self-contained and may be quickly removed and a new toolholder placed in the machine, when the cutting tools become dull. This change is facilitated by means of a hinged member, which pulls the cutter head out into a position such that the loading crane can remove it. The toolholders are arranged for six cutting tools 3x2 in., which are of sufficient length to allow a considerable amount of grinding before they become too short for use. Tools are clamped and adjusted in the toolholder before placing it in the machine, a gage being provided for setting the tools. The holder is driven by two large keys, diametrically opposite, and the thrust is taken against a shoulder in the hub of the cutter head gear. A pair of toolholders is furnished for each inch of billet diameter. Internal adjustment of the tools provides for the fractional diameters.

Hydraulic feed by means of a high-pressure pump and accumulator system giving a pressure of either 1,000 or 1,500 lb. per sq.in. is arranged for. The cylinders are made from bored steel forgings with cast-steel heads. The pistons are hollow-bored nickel-steel forgings to resist corrosion. All cylinders are single-acting, outside packed, and particular attention has been given to accessibility of packing. The amount of feed to the entering and discharge side carriages is controlled by separate needle valves placed between the pressure line and the operating valves. A needle valve on the discharge side carriage feed allows the operator to rapid traverse the discharge side carriage in the feed direction so that the billet may be run out and released as soon as its end has passed through the cutting tools. The push-back cylinders are fastened one on either side of both carriages. The pump and accumulator are extra.

The customer is expected to furnish the discharge bed or skidway built at the rear of the machine to form an extension to the skids on the discharge side of the cutter head. As the discharge bed is usually made quite long, it is important that the billets do not start down the skids in a skewed position. To prevent this, a set of air-operated paralleling stops are provided, these being mounted near the machine on the discharge bed. Two unskilled operators can operate the machine easily to its maximum capacity, one operator on the hydraulic feed and air clamp valves and the other on the crane controls.

Jones Aluminum Ingot Scalping Machine

TO OBTAIN a perfectly smooth surface on aluminum ingots previous to reduction in a plate mill, the scalping machine illustrated was developed by the Jones Machine Tool Works, Inc., 5,300 Lansdowne Ave., Philadelphia, Pa. This scalping operation, performed on the opposite sides of the billet, is necessary because scale, scratches, gouges and tool marks would otherwise show up in the rolling process. In Fig. 1 is shown the operating side of the machine with centralized controls, the cutter head with its safety cover, and the revolving turret fixture.

To eliminate these tool marks or scratches, the scalping machine car-

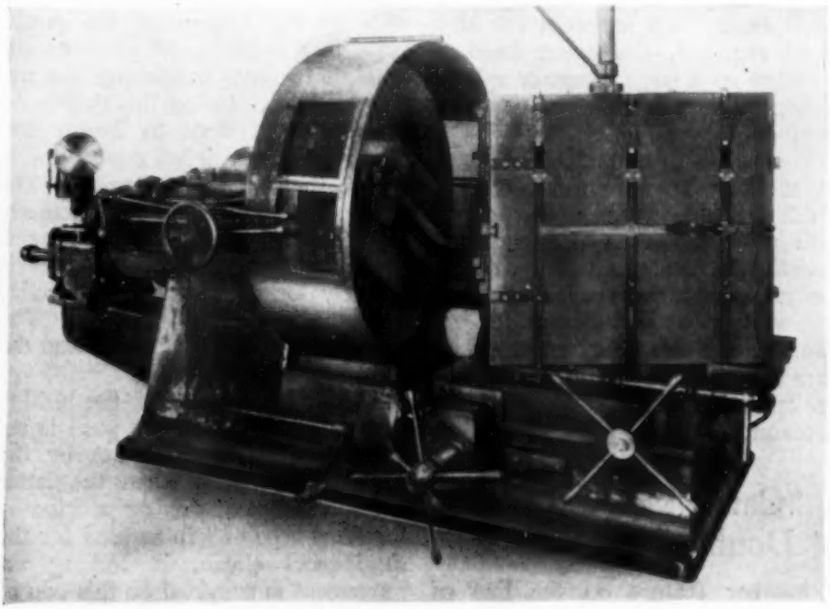


Fig. 1—Operating side of the Jones Aluminum Ingot Scalping Machine showing the centralized controls, the cutter head, and the revolving turret fixture

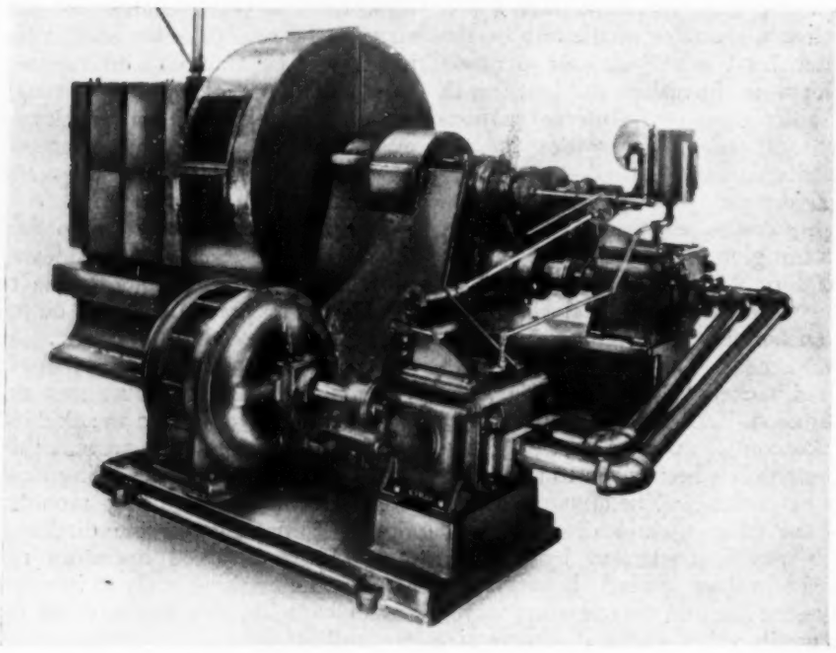


Fig. 2—Rear view of the machine showing the Waterbury oil pump and motor unit

ries a large diameter cutter head containing a single cutting tool, which feeds from the periphery of the cutter head toward the center. Since a fixed, fast cutting speed must be maintained at all diameters, the cutter head is driven by means of a Waterbury oil pump and motor and gearing so that the speed is increased automatically as the center is approached by the cutting tool, thereby maintaining the correct cutting speed at all times. To maintain the high speed required, the cutter head is mounted on a large diameter spindle fully equipped with Timken precision bearings.

The ingots to be scalped or faced are mounted on a four-sided turret, which is hand rotated and equipped with a quick-loading and clamping device. By loading all four sides of the turret, which is equipped with adjustable stops and clamps for various size billets, the operator can keep the machine in almost continuous operation by presenting each side in turn to the cutter head.

"Canco" Presses with Double-Pawl Clutch

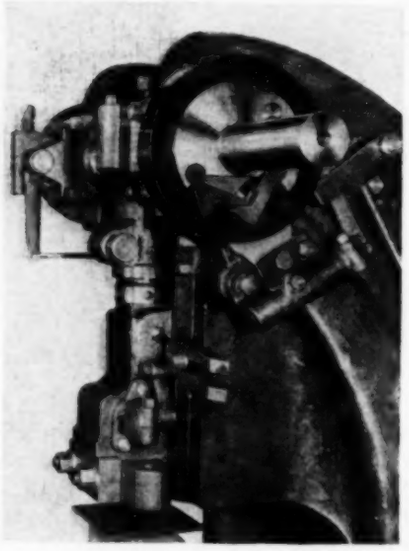
Another feature on the line of "Canco" presses made by the Equipment Division of the American Can Company, 120 Broadway, New York, N. Y., is a double-pawl clutch, which can be used in place of the present single-pawl clutch. The line of presses, made by this company for its own use for many years, was placed on the market last year and was described on page 1021, Vol. 68, of the *American Machinist*.

In addition to the present striking pawl there is a locking pawl, working in the opposite direction, that eliminates rebounding of the press slide at the bottom of the stroke since this second pawl prevents the crankshaft from overtaking the flywheel. In developing this unit nothing has been done to impair the strength of the original design nor to reduce the speed of operation. The double-pawl type is particularly recommended for deep drawing work as in its operation the flywheel is securely locked to the clutch collar until the stroke is completed. The Canco cam-operated brake is also designed to prevent backlash.

The disengagement of the locking pawl is positive, and the pawl is returned to its free position by the clutch pawl itself, when the latter is cammed out of driving position by the same type of trip as used for the single-pawl clutch. A locking arrangement is provided on this trip so that the treadle cannot engage the latch, when a workman is setting dies or working under the punch.

The locking pawl, like other members of the clutch, is made of tool steel, hardened and ground, and has a long substantial bearing to reduce wear. The crankshaft has been modified to take care of the two-pawl clutch, but the diameter of the crankshaft is maintained. It is made of chrome-nickel steel, heat-treated and ground, as before. Six points of engagement are provided on a hardened steel ring, which is pressed and keyed into the flywheel.

Simplicity and massive construction are featured. There are only two moving parts in the clutch and no springs are used; the brake is so designed that the crankshaft always



"Canco" Press equipped with a Double-Pawl Clutch. Only the inset ring of the flywheel is shown

stops in a position where both pawls will drop into position by gravity.

The clutch has been adopted as standard equipment on all of the Canco OBI line of presses and can readily be used where necessary on the horn presses, although the nature of the work usually done on these latter machines does not require the double-pawl type of clutch.

K & S Pocket Radiation Pyrometer

All the necessary parts for accurate temperature measurement are contained in the K & S pocket pyrometer placed on the market by the Colonial Supply Company, 217 Water St., Pittsburgh, Pa. All working parts

K & S Pocket Radiation Pyrometer

are completely inclosed and protected in a dustproof housing, the overall dimensions being 6 in. long and 2 in. in diam., and the weight 6 oz. Ten scale ranges are available, these being from 1,100-2,600 to 1,110-4,000 deg. F., and 600-1,400 to 600-2,200 deg. Centigrade.

The principle on which this pyrometer operates is the measurement of the total radiant energy emitted by hot bodies, whose temperature is to be determined.

The scale is transparent and can be seen at the same time the glowing surface is viewed through the occular, enlarged about eight times. To protect the eye against the bright rays, a red glass is provided.

Langelier No. 6 HS 11 Swaging Machine

AUTOMATIC work feed obtainable either by means of compressed air or by an Oilgear hydraulic-feed unit is available on the No. 6 HS 11 swaging machine made by the Langelier Manufacturing Company, Arlington, Cranston, R. I. A number of other improvements have also been incorporated in this machine, as well as in others of the line from Nos. 5 to 8. The capacity of the No. 6 HS 11 machine, which can be used for either hot or cold swaging, is 3-in. steel tubing, 1¾-in. solid rods cold, and 2¼-in. solid rods hot. The die used is 3⅞ in. in width, 2¾ in. in height and 11 in. long, but the machine can be supplied with die lengths varying from 6 to 12 inches.

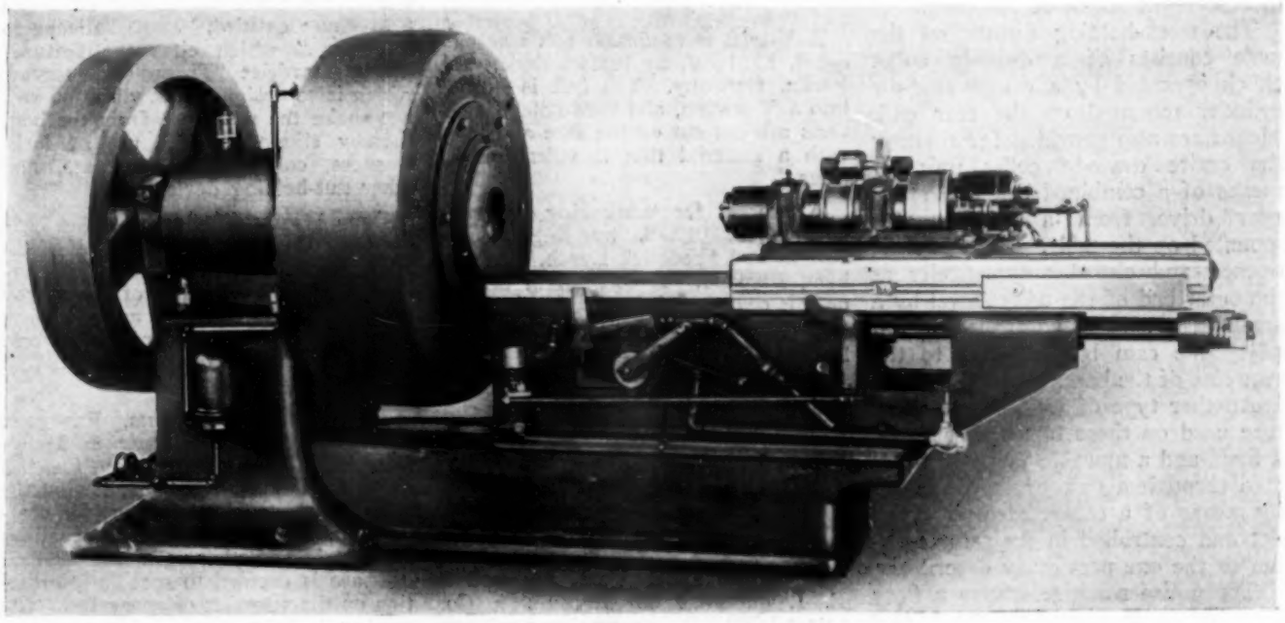
In this machine, which is of the stationary-head roll type, twelve head rolls, 3-in. in diam. made of special steel, hardened and ground, are used. The spindle head itself is 13⅛ in. in diam. and at the bearings it measures 6¾ in. A 3-in. hole runs through the spindle for use in working long pieces. The spindle die slot is lined in the usual manner with a hooked steel liner, hardened and ground, and riveted in place. Bronze bearings carry the radial load on the spindle, and a hardened and ground steel washer takes up the swaging thrust against the spindle.

Separate lubrication is used for the spindle proper and on the die blocks. The spindle bearings are lubricated by sight-feed oilers, while the head rolls, dies, and hammer blocks are lubricated by a forced-feed circulating system incorporating a "Purolator" for removing the grit and scale coming from the piece being worked.

The spindle plate is extra thick, and is held in the head by an annular tongue and groove, being fastened to the end of the spindle by six tight-fitting capscrews with lockwashers. Screwed into this spindle plate is a plug that holds the dies into the die slot of the spindle. It is locked in place against a shoulder by a collar capscrew.

The head itself is a heavy one-piece casting with a water jacket cored into it for use on hot swaging work. The twelve fixed roll holes are bored into a separate roll bushing of semi-steel that is forced into the head under heavy pressure and locked in place. This bushing can be driven out and replaced when worn. At the other end of the spindle is a flywheel 43 in. in diam. by 8½-in. face, which is made heavier than in the older models. It is double keyed and clamped to the end of the spindle by two bolts to avoid any possibility of its working loose. The entire head is bolted to the one-piece base by heavy studs and locknuts.

One of the features of the work-holding and power feeding unit is heavy construction to avoid vibration. The entire unit is bolted to the projecting part of the swaging machine base. The feeding table itself is extra heavy and has a flat surface 21x48 in., with two lengthwise T-slots for attaching various types of work-



Langelier No. 6 HS 11 Swaging Machine

holding fixtures. The table has a maximum travel of 30 in., and is operated by a compressed-air cylinder mounted inside of the holder under the table. As mentioned in the early part of the article, the table can also be operated by an Oilgear feed, depending upon the class of work being done. Air-type feed is recommended for light work, but where the work is heavy, where large tapers are to be formed, or where the work is to be done against an abrupt shoulder, the Oilgear type of feed is recommended.

In the air-type table control, the control mechanism consists of a four-way valve, a "Curtis" speed-regulating box to maintain a constant air pressure for a uniform rate of travel, a hook-up lever and a bell crank lever that controls the speed-regulating box.

TABLE TRAVEL ADJUSTABLE

On another T-slot on the side of the table are two dogs for regulating the travel. The smaller one shown to the left reverses the travel of the table, while the long one shown at the right regulates the point at which it is desired to change the rate of travel from rapid advance to the swaging rate of feed. This speed can be regulated to any desired amount by adjusting the speed-regulating box. The reversing dogs are adjustable along the table. When the front dog comes in contact with the hook-up lever, the table is reversed at a rapid rate to the stop nuts. Springs are used against these nuts to absorb the shock of stopping.

The work-holding fixture on the table consists of a draw-in collet chuck operated by a compressed-air cylinder mounted on the rear end. Means are also provided for rotating the entire draw-in collet unit by means of a combined belt and spur-gear drive from a small motor mounted on the table. The chuck is opened and closed automatically at the outer end of the table travel by a small piston valve controlled by an adjustable cam bar attached to the rear side of the base.

Another type of work-holding fixture used on these tables consists of a fixed and a movable jaw vise operated through a pair of toggle levers by means of a compressed-air cylinder and controlled in the same manner as the one previously described.

The entire machine covers a floor space of 4x12 ft. and weighs 16,000 pounds.

REVIEW · OF · RECENT · PATENTS

Relating to the Machinery and Metal Products Industries

Parts and Mechanisms

A heavy-type of thrust bearing was patented, 1,700,856, and assigned to the Sperry Gyroscope Co. It comprises a number of bearing segments resting on a spherically-curved surface, together with a suitable housing base. A means is provided for lubricating by the pressure created at the bearing segments.

A patent, 1,700,866, on a radial and end thrust roller bearing was issued to Elmer J. Tschantz, of Canton, Ohio. The rollers have one end rounded to fit into the fillet of the shaft, and are encased in a cage that holds them in place longitudinally.

The Brown & Sharpe Manufacturing Co. was assigned a patent, 1,700,974, on a pivoted dog for engaging and locking the teeth of a rack.

A universal joint patented, 1,700,991, by John B. Wintercorn, of Chicago, Ill., has the feature that the pieces of the yoke are welded together after the joint is assembled.

A loading device for work-holders was patented, 1,701,448, and assigned to the Heald Machine Co. In the device the work-holder is positioned in a work-centering plug secured to a centering plate in the base.

The Fafnir Bearing Co. was assigned a patent, 1,701,474, on a novel form of anti-friction bearing, in which taper roller bearings on each end of the bearing are held in place by pressed-metal shackles held by connecting bolts.

Materials

A V-type transmission belt was patented, 1,701,507, by Rudolf Roderwald, Berlin, Germany. The belt is formed into a V-section, and then notched sections are cut out on the face and filled with a material that is vulcanized in place.

A process for toughening taps was patented, 1,701,570, by Reginald F. Knight and Frederick Lynch, of Burnham, England. It consists in drilling out the center of the tap and filling with a softer material, after which the tap is put through the hardening process.

A patent on a method of counteracting the thickening of a rubber-containing paint in the presence of air was assigned to E. I. du Pont de Nemours & Co., 1,700,778. It consists of adding an aromatic hydroxyl compound with reducing properties to counteract the action of the drier and pigment.

A coating material was assigned to E. I. du Pont de Nemours & Co., patent 1,700,779. It comprises a mixture of rubber and a dryer in such proportions that the coating will be cured by exposure to temperatures up to 500 deg. F. Another mixture containing a volatile thinner and a drier but no drying oil, will cure in air by the evaporation of the thinner.

A preparation for cleaning metal preparatory to painting was patented by James D. Klinger and Clete L. Bazle, of Detroit, Mich., 1,700,739. The composition consists of an ordinary rust-removing acid with the monoethyl ether of ethylene glycol.

Trade Publications

COUNTERBORE HOLDERS. The Eclipse Interchangeable Counterbore Co., 7410 St. Aubin Ave., Detroit, Mich., has published a folder showing the two new types "SD" and "R" improved quick-adjustable-length holders for counterbores. The folder lists the various sizes manufactured.

CRANES, PORTABLE. The Canton Foundry & Machine Co., Canton, Ohio, has issued a booklet entitled "Portable Floor Cranes and Hoists," which shows several types equipped with safety friction load brakes. Dimensions of standard and special models are given. The booklet contains 31, 7½x4-in. pages.

DARDELET THREADLOCK. The Dardelet Threadlock Corporation 120 Broadway, New York, N. Y., has published a brochure entitled, "The Challenge to Vibration," which cites the features of the Dardelet "Threadlock" thread, which is so designed that vibration will not shake the nut loose from the bolt, thereby eliminating the use of lockwashers, cotter pins, jam nuts, and other nut-holding devices.

DROP HAMMERS, STEAM. The Erie Foundry Co., Erie, Pa., has published Bulletin No. 190, giving the characteristics of design of its line of steam drop hammers. Photographs are included, together with the standard dimensions. The bulletin contains four 11x8½-in. pages.

HEATING APPLICATIONS, ELECTRIC. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has published Catalog No. 250, showing the application of electric heat to heat-treating, enameling, melting of alloys and metals, and other uses. A good deal of space is devoted to specific information on the selection of apparatus. The catalog is fully illustrated throughout. It contains 72, 11x8½-in. pages.

News of the Week

McGraw-Hill Editors Complete Southern Tour

A party of twelve executives and editors representing the McGraw-Hill Publishing Co., publishers of the *American Machinist* and twenty-four other technical, industrial, and business papers, made an industrial survey of the southeastern states, leaving New York on March 3 and returning March 17. The party visited 20 cities and towns in 7 states, and was conducted through 80 industrial plants. The itinerary included: Charleston, W. Va.; Richmond, Petersburg, and Hopewell, Va.; Greensboro, Winston-Salem, High Point, Gastonia, and Charlotte, N. C.; Spartanburg and Greenville, S. C.; Savannah, Brunswick, and Atlanta, Ga.; Birmingham and Bessemer, Ala.; Chattanooga, Johnson City, Kingsport, and Bristol, Tennessee.

The purpose of the editorial survey was to witness at first hand the tremendous industrial development now going on in the South in order to coordinate the work of the various papers of the McGraw-Hill organization in keeping their readers correctly informed on the development that is affecting the whole country. At each town the editorial party was greeted by representatives of the Chambers of Commerce and by the industrial leaders. Every courtesy was extended by the Southern industrialists for the editors to see the plants and to study methods, raw product resources, labor conditions, and other factors of the industrial development of these States.

The party was headed by Dr. H. C. Parmelee, editorial director of McGraw-Hill, and included E. J. Mehren, editor of the *Magazine of Business*, Earl Whitehorne, and editorial representatives of *American Machinist, Factory and Industrial Management, Textile World, Industrial Engineering, Engineering News-Record, Electrical World*, and *Chemical and Metallurgical Engineering*.

New Britain-Gridley Merger Announced

Stockholders of the New Britain Machine Co., New Britain, Conn., met March 8 and voted to merge with the Gridley Machine Co., Hartford, Conn. Through this action the Hartford company becomes the New Britain-Gridley Machine Co., and will operate as a subsidiary. The consolidation provides for an issue of 100,000 shares of stock of which the New Britain Machine Co. will control 80,000 shares by transfer of $1,124,385 in assets of the new company. The New Britain-Gridley Co. will do all machine tool manufacturing, while the New Britain plant will manufacture hardware, shop equipment and screw products.

Robert T. Frisbie, assistant secretary of the New Britain Machine Co., was added to the board of directors, which also includes John H. Goss, F. G. Vibberts, P. B. Stanley, W. S. Rowland, H. H. Pease, E. M. Goss, R. S. Brown, L. P. Broadhurst, and P. K. Rogers.

Professor Jenkins Dies

A. Lewis Jenkins, 47 years old, head of the mechanical engineering department, College of Engineering and Commerce, University of Cincinnati, died on March 8, after a prolonged illness. Professor Jenkins was known throughout America and Europe for his research on machine tools and the designing of heavy machinery. His publication on the analysis of combined stresses and their application to the practical design of machine tools, hydraulic presses, punching and shearing machinery are widely quoted in textbooks and engineering literature.

A. Lewis Jenkins

Dr. Herman Schneider, former dean of the College of Engineering, and acting president of the university, said: "The death of Professor Jenkins is a great loss to the University because of his fine personality and his wide knowledge of theory and practice in the field of mechanical engineering. He was known internationally as an expert in the finer and more intricate phases of machine design. His advice frequently was sought by engineering experts. His standing in the profession was indicated by the fact that he was president of the Engineers' Club of Cincinnati, and in recent years had been a member of important committees of the A.S.M.E."

Professor Jenkins was born near Springfield, Ky., January, 1881. He was graduated from the University of Kentucky and the University of Cincinnati. Before coming to Cincinnati he was engineer of the municipal pumping and power plant of Jackson, Tenn.

It has been his aim during his 24 years of service at the University of Cincinnati to develop methods of teaching and courses of instruction in mechanical engineering subjects which were adapted to the co-operative plan of education. During 1924-25 he was exchange professor at Roberts College, Constantinople.

Machine Tool Orders Reach Peak

During the short month of February, a large order volume brought the index of the three months' average of machine tool orders across the 300 mark for the first time since 1919, according to the National Machine Tool Builders Association. The index of 100 is the average shipment for the years 1922-3-4. Despite the fact that shipments speeded up considerably during the month, the index of unfilled orders rose to 701, the highest since this item began to be reported in October, 1925. The ratio of unfilled orders to shipments still shows about a 70-day average backlog, and because of this increase the relative scarcity of labor is being felt now more than ever before.

The general trend of profit seems to be rising. Reports of companies making public reports show that profits for the first quarter of this year will probably run very much ahead of the profits established for this same period last year, and new records are expected. With all these factors, the industry may be considered enjoying boom times.

Navy to Purchase Machine Tools

Bids on new equipment to the value of $133,500 for the Naval Gun Plant in the Washington Navy Yard will be invited during the last week in March, it has been stated by officials of the Ordnance Department of the Navy. A total amount of $200,000 was appropriated by Congress to enable the Naval Gun Plant to obtain equipment needed for the work on the guns and mountings for the fifteen cruisers and the airplane carrier provided for in the Cruiser Bill.

Among the equipment which will be purchased for the Washington Naval Gun Plant, the following items are listed: a portable 24-in. slotter, an 8-in. universal radial drill press, a 25-ft. boring mill, two milling machines, and a sand mixer. A sand blast room and a cleaning shed will be constructed also.

BUSINESS BAROMETER . . . . . *Some falling off from the present peak of activity will be compelled within the next few months if business is to remain healthy*

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

THE wide-spread and universal demand for credit is the outstanding feature of the world's economic situation at present. The bank rate in London stands at 5½ per cent. It is confidently expected that the Federal Reserve Banks of this country will soon commence to raise their rates to the same figure.

In Italy the bank rate was raised last week, and it is said that the rate in the Netherlands will soon be raised. Germany has shipped $18,000,000 of gold to this country, another shipment of almost $5,000,000 is on the way from the Argentine, and France has released from earmark some of her gold holdings in the United States. Canada is protecting her exchange to conserve her gold and even sterling has been flirting again with the gold shipment point. All these facts indicate that another general advance in bank rates over a good part of the world is possible.

Day by day it is becoming plainer that there are only two ways in which the United States can be rescued from the monetary stringency by which it is already affected and even more seriously threatened.

One is by deflation, especially in the stock market, which will reduce prices and diminish the amount of credit required to carry undistributed securities. That is the course upon which the Federal Reserve Banks have set themselves, but with such a conspicuous lack of success that in the five weeks since the Board's warning was issued brokers' loans in New York have been reduced only $40,000,000. The policy of "selective" deflation is equivalent to drawing money from one department of business and lending it to another. Of course, the effect of this procedure would be to cripple the business from which the money was withdrawn. But "selective" deflation is technically very difficult to enforce.

The other way out is by inflation, or an increase in the volume of currency or credit. An increase in the volume of currency would be pure inflation, an extreme example of which is to be found in the policy pursued by Germany after the war, when she issued paper marks in such enormous quantities that they became almost worthless, and were largely bought by German corporations and mortgagors to pay off their funded debt.

Of course it is unthinkable that the United States should follow the latter method, but we have already experienced an increase in the volume of credit much greater than the expansion of trade and industry that has taken place, and it is possible that the high rates that money is now commanding here may attract enough gold to produce a further inflation instead of the deflation which the Reserve authorities are trying to bring about.

Last week's happenings point to this possibility. If to the gold shipments now afloat any further large quantity is added, the effect may be a secondary period of gold inflation, in the course of which the value of gold may again be marked down and the prices of commodities marked up.

Those who think we shall continue to gain gold point out that we are creditor of the world to the extent of over fifteen billions of dollars, exclusive of the war debts. On these loans alone the interest at the low average of 6 per cent is nearly a billion dollars annually, and, in addition, other countries are constantly buying from us more goods than they are selling to us. Therefore it seems inevitable that we shall attract all the free gold of the world, and exert on Europe's central bank reserves a magnetic pull, which demands that they be constantly protected by high bank rates or support of the exchanges.

During the past few years this attraction of the creditor nation for gold has been neutralized by our huge loans abroad, but, at present high money rates, foreign business is no longer borrowing in this country to its former extent. The result is that fewer credits are being set up here to make it unnecessary for our creditors to ship their gold, and they will perforce be compelled to send us all they can spare and to protect their bare minimum requirements by high money rates and some co-operative banking action to which the United States must necessarily be a party.

Unless such action is quickly invoked this country is likely to receive more gold and its arrival undoubtedly would be interpreted by the stock speculators as a signal for a renewal of their activities.

Business as a whole is the largest in volume that the United States has ever experienced. The automobile and the tire manufacturers are breaking all records and the iron and steel mills are working almost at full capacity.

In interpreting these facts, however, the probability that stocks of manufactured goods are being accumulated is apparent. In the steel industry it is reported that in the endeavor to obtain deliveries some duplicate orders are being placed, which is a sure cause of overproduction. Therefore some falling off from the present peak of activity will be compelled within the next two or three months if business is to remain healthy.

But the reduction need not be severe if it is effected in time; and if meanwhile gold continues to come into the country to relieve the threatened money stringency, the future of commerce and industry can be viewed with confidence.

BUSINESS in machine tools and machinery has been so good both before and since the first of the year that the industry may be considered as enjoying boom times. The index of orders of the National Machine Tool Builders' Association shows that February was a record-breaking month, despite its shortness, and there are many indications of a nation-wide buying program on the part of nearly all metal-working plants, both large and small. The New England Council shows by its indices also that metal-working activity in that region has set a new high record.

CHICAGO reports that exceptional production activity throughout the Midwest is responsible for the maintenance of high sales of machine tools in that center. With an excellent volume of orders in February and with March prospects bright, business during the first quarter ought to be record-breaking. The Cincinnati tool builders see no probability of decreased manufacturing activity and report a steady volume of orders and inquiries. In Detroit also dealers have found March a satisfactory month from the standpoint of sales, inquiries and general prospects. In Canada orders from the automotive and carbuilding shops are producing a very satisfactory volume of business.

ONLY in the South have sales been below what they were at this time last year, except in the textile mill supply field, where there is considerable activity. However, an upward trend in the demand for machine tools and machinery has been noticeable since the first of the month, so that the South should soon be in line with the rest of the country.

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The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW ENGLAND

The excellent rate of activity displayed by the metal-working industry in New England is clearly and forcefully shown by indices computed by the New England Council. Going back to 1927 the metal group operated at a rate of activity represented by the index 117.2; while last year, average monthly operations resulted in a jump represented by the index 137.7. The present year brought increased business, and at the close of January, activities had stepped up the rating of 173.0, a new high record.

All New England industries, with the leather and paper group excepted, are according to indices completing the first quarter of the year at an encouraging rate of activity. Improvement in the textile field has added stability to the situation, and has been welcomed by textile machinery builders and dealers. A manufacturer of this line anticipates his best first quarter in several years.

Business was good during the current week, and buyers continue to represent a wide field. Extended deliveries on certain items of machinery has had a tendency to expedite buying on the part of shops planning considerably in advance. The radio industry is taking a large supply of small automatics. There is a steady demand for grinding units, drills, lathes and presses from many sources. The trade finds no reason at this time to expect a letdown in view of the strong and steady inquiries coming in.

DETROIT

March thus far is proving a satisfactory month from the standpoint of sales, inquiries and general prospects. Nothing of an outstandnig nature has developed, but all of the automobile manufacturers are still coming into the market for a variety of equipment, much of it small. Business in general has been very good since the first of the year, and with the increases in automobile production that have already been made and those that are in prospect, the indications for the first half of 1929 are still at least as good as they were at the first of January. Automobile manufacturers are making plans for a bigger year in 1929 even than 1928, and, although these plans in many cases have not yet been transformed into orders, there is every reason to believe they will be soon.

Oakland, Cadillac, Buick, Chevrolet, Ford, Reo, Hupmobile, Graham-Paige, Hudson, Studebaker, and Chrysler have all been in the market for machinery and equipment. All these organizations have been expanding, and are continuing to buy. Continental Motors has been active as have Packard, Kelsey Wheel, Briggs, Fisher, Murray, and others. The Durant interests have been in the market for equipment of various kinds. The automotive industries are still the only real market for machinery dealers here, but within the past year there has been a wider diversity of output in this field.

Airplane and boat motors have become increasingly important and the indications are that they will continue to advance. Thus far the machinery dealer has not been concerned very much by this growth, but, with the growing popularity of both motor boats and airplanes, motor manufacturers are beginning to spend money for production, and this is a field that will increase in volume, according to the predictions of those closest to the industry. Among the leaders in the motor boat field here are Dodge, Smith and Chrysler. There are a number of smaller ones also, most of them prosperous.

SOUTHERN DISTRICT

Though weather conditions slowed up business considerably the last week or so of February, there has been a turn for the better since the first of this month, and machinery, machine tool and mill supply dealers practically all report an upward trend in the demand. However, as a whole, sales are not as large as they were at this time last year with the exception, possibly, of the textile mill field, and unless conditions improve to a considerable degree during the last half of March, the volume of business for the first quarter of 1929 will run well below that for the same period last year.

In the textile field there is considerable activity, and with several million dollars worth of new mill construction now in progress or planned for the southeastern district, the outlook is the best in some years in this field. Recently the industry placed a number of sizeable orders for mill and machine shop equipment, and inquiries indicate that there will be a number of other large orders of the same kind placed within the next few months.

There has been less buying than expected in the woodworking field, and, although some orders from furniture plants have been booked in the last two weeks, the volume as a whole is less than for the corresponding period of last year.

Road-building equipment sales are beginning to open up, and in most of the southeastern states the outlook is for at least a normal season. However, sales to builders and contractors have been slow ever since the first of the year, because of the lack of building activity, and indications are not very promising for any material improvement in such business.

CANADA

Brisk orders from automotive plants and car-building shops are providing machine tool manufacturers in Canada with a very satisfactory volume of business. The production of automobiles in January at 21,501 cars was the greatest output reported for any January on record and was 154 per cent greater than the production in January a year ago.

As an example of the activity in locomotive shops, the president of the Canadian Locomotive Co., recently reported that the company had entered the year with six months' business on the books. He regarded the prospects for 1929 as particularly bright and anticipated good equipment buying for some years to come.

Orders from the farming districts for agricultural machinery are keeping implement makers working at capacity. The general tone of the agricultural machinery market is steady, and further prospects promise an excellent volume of business.

Steel plants both in the east and middle west are well employed. The rail mills of the Algoma Steel Corporation rolled 27,100 tons of 100-lb. rails in February, as against 16,000 tons for the same period last year. Practically 100 per cent increase is shown in the merchant mills and allied steels.

Inquiry as to the probable amount of Canadian manufacturing of heavy machinery for mines and mills during the current year brought to light the encouraging information from William Hamilton, Ltd., Peterboro, Ontario, that since the beginning of October, 1928, it has booked orders that total more than the whole of its last year's business.

There is unusual activity in the electrical equipment field and the outlook is the most promising in years. It has just been announced that contracts for hydraulic and electrical machinery and power plant equipment for the British Columbia Electric Railway Co.'s $7,250,000 power project at Ruskin, are to be let almost immediately.

Old material demand is good. Heavier lots are now changing hands in both iron and steel, and inquiries forecast further steady business.

CINCINNATI

With very few exceptions the machine tool manufacturers of the Cincinnati district report that in the past week sales continued to be at a good level. In a small number of cases it was reported that sales dropped slightly below the level of the previous week, but this was regarded as merely a temporary lull. Orders now booked, it is stated, will keep production at its present level for some time to come, and as new business is developing all the time, there is no probability of decreased manufacturing activity.

Selling agents report that in the past week their sales were at about the same satisfactory level as in the previous week. Considerable new business is developing in local and adjacent territory, it is stated, and, as sales resistance is diminishing, it is thought that there will be less delay in closing orders than heretofore.

The sustaining feature of the week's market was the sale of single tools and replacements to general machinists and miscellaneous users. Orders booked came from all sections of the country and were well diversified. However, there were scattered orders for several tools, the greater portion of these being from makers of automobile parts and accessories. Railroads, which one manufacturer characterized as now being the "weakest spot in the market," placed a few orders for single tools.

The week's inquiries, it is reported, were large in number and of excellent tone. In the automotive field the principal inquirers were makers of parts and accessories.

CHICAGO

To exceptional production activity among manufacturing plants located in the Chicago industrial area, in particular and the Midwest generally, the latter comprising the states of Illinois, Indiana, Michigan, Wisconsin and Iowa, is credited the high level being maintained in the machine tool industry of this section. February was an excellent month in point of business transacted, some concerns reporting a material increase over January, and present indications are to the effect that this month's business in machine tool equipment will not fall below and probably may exceed that of the first two months of the year.

No sales of major importance have been reported, the general demand contemplating small lots and single tools, among the latter a number of heavy-duty type. An exception to the rule is the call for punch presses, which are in big demand, one manufacturer's agent having sold more than twenty presses recently.

Deliveries on most types of machine tools

are improving to some extent, guarantees in many instances now being from six weeks to two months, instead of from three to four months, as formerly. Dealers in used tools report a good sale for units in first-class condition, with prices being well maintained.

NEW YORK

Conditions have remained at a high level in the machine tool trade in the metropolitan district for the past few months after a steady climb during the preceding year. On all sides a good healthy volume of well scattered orders is reported, and the number of sales pending give confidence for the immediate future at least. Each week sees a new record of sales established by some dealer or factory representative, the past week being no exception to this rule. Another indication of present prosperity is given by the statement of one dealer to the effect that his billings for the first two months of this year were over double those of the same period last year when the present boom began.

Few large orders are reported, most sales being for small lots. Among the buyers in reecnt weeks have been the General Electric Co., the Wright Aeronautical Corporation, the Victor Talking Machine Co., the Federal Bearings Co., the Western Electric Co., and the Foote Pierson Co., of New York, for its new Newark plant. No action has as yet been taken by the Board of Transportation of the City of New York for the uptown subway shops which are nearing completion, and it is not expected that any formal inquiry will be issued for some months. Other railroad buying is practically at a standstill, the exception being the New York Central R.R. which has been buying steadily, but not in great volume, before and since the first of the year.

Among the sales made by the Triplex Machine Tool Co. during the past week were: Three Swiss jig borers, two metal bandsaws, two Oesterlein milling machines, a surface grinder, two universal grinders, five multiple sensitive drill presses, one Ames bench lathe, an Ames bench miller, two bench lathes, three hand milling machines, a 16-in. rotary surface grinder, a drill grinder, two belt sanders, a radial drill, a Campbell nibbler, and an Excel filing machine.

Business Items

The Industrial Controller Co., of Milwaukee, and the Square D Co., of Detroit, both manufacturers of electrical control equipment, have agreed to merge, but the physical details of the merger are yet incomplete. The former company will be known as the Industrial Controller Division of the Square D Co. T. J. Kauffman, head of the consolidated company, is president; F. W. Magin, Carlton Higbie and W. L. Mercer will be vice-presidents; and W. C. Worcester, secretary and treasurer. Both companies are constructing additions to their plants. A five-story addition will increase the capacity of the Square D plant 20 per cent, and a three-story addition will increase the capacity of the Industrial Controller Division in Milwaukee 50 per cent.

The American Swiss File & Tool Co., Elizabeth, N. J., has appointed the Tucker Co. Inc., 75 Murray St., New York, N. Y., distributor for its line of mechanic's hand tools and knurls. The Tucker Company's territory will include New York, New Jersey, New England, Pennsylvania, Delaware, Maryland and the District of Columbia. This appointment does not affect in any way the distributors of American Swiss precision files in this territory as their manufacture and sale is entirely separate from that of the hand tools.

The Geo. D. Roper Corporation, of Rockford, Ill., announces the appointment of Lewis & Co. of Philadelphia, Pa., as its representative in the territory comprising the entire states of Delaware, Maryland, New Jersey, Virginia, and the District of Columbia, and the eastern section of Pennsylvania as far West as Altoona. The Lewis firm will distribute the Roper line of Trahern rotary gear pumps, including coolant pumps and fuel oil pumps.

The Surface Combustion Co., Toledo, Ohio, manufacturer of gas burners and gas-fired furnaces for industrial purposes, has purchased the Webster Engineering Co., of Tulsa, Okla., maker of low-pressure gas burners for power boilers and industrial uses. The offices and shops of the Webster company will be maintained at Tulsa and will be operated as a division of the Surface Combustion Co. Henry O. Loebell has been made president of the Tulsa firm, and L. S. Reagan general manager.

The Excello Machine Co., 412 Umatilla St., S.E., Grand Rapids, Mich., has recently doubled the space occupied in making printing machinery and for commercial gear-cutting and has installed extensive equipment for giving gear cutting and machine shop service to plants in the vicinity. The company specializes on service on Formica gears to west Michigan plants.

The Heating Systems Corporation, Joliet, Ill., will begin work soon upon a $100,000 factory on Kronmeyer St., and will employ a force of 150 in the manufacture of its "Heat-O-Warm" automatic hot-air furnaces, steel boilers, heat boosters and warm-air cabinets. The corporation is successor to the Heating Systems & Supply Co., for many years located in Chicago.

On page 418f of the March 7 issue of the *American Machinist* the City Auto-Stamping Co., of Toledo, Ohio, is mentioned as being closely associated with the City Machine & Tool Co. of Dayton, Ohio. This was an error. The latter firm mentioned is the City Machine & Tool Co., of Toledo, Ohio, an independent company.

Dayton & Dunbar, Inc., 149 Broadway, New York, have been appointed agents for the line of hydraulic presses, broaches and pump units of the Oilgear Co., of Milwaukee, in the metropolitan area, including New Jersey as far south as Trenton, New York to Schenectady, and Massachusetts and Connecticut as far east as the Connecticut River.

The Stuebing Cowan Co., maker of lift and industrial trucks and skids, with general offices in Cincinnati, Ohio, has recently enlarged its Holyoke (Mass.) plant. Considerable new equipment has been added and the capacity tripled. The company reports 1928 as the largest year in its history and that 1929 prospects are extremely bright.

The Auto-Karyall Manufacturing Co., Sioux City, Iowa, has been incorporated with $150,000, and will begin operations in a plant at Lafayette & Fourth Sts., manufacturing an automobile trunk luggage carrier. O. D. Nickle is president and A. L. Shidler is secretary.

The Barnard & Leas Co., Moline, Ill., will erect a new foundry and institute other improvements at a cost of $100,000. The improvement work will prepare for increased production schedules to be effective this year. A. R. Weigel, general manager, was elected a director.

The National Twist Drill and Tool Co., of Detroit, represented in Chicago by E. J. Chamberlin, on May 1 will remove from its present Chicago quarters, 26 S. Jefferson St., to its new three-story building at 1144 W. Washington St. The company will occupy the ground floor and rent the two upper ones.

The Stevens Manufacturing Corporation, of 46 E. Houston St., New York, has leased larger and more modern quarters at 40 Spring St., Newark, N. J., where 40,000 sq.ft. of floor space is available. The company manufactures loud-speakers and diaphragms.

The Rockford (Ill.) Forging Die & Tool Co. has been incorporated with $20,000 capital, and is operating on second floor of the Nels Billstrom factory on Eighteenth Ave., Rockford. Eric Anderson, Bror Cedarleaf, E. W. Johnson and E. R. Johnson are the incorporators.

The Reading Iron Co., Reading, Pa., manufacturer of wrought iron pipe, announced recently the opening of a new branch office in the southeastern territory with headquarters at 1216 Hibernia Bank Bldg., New Orleans, La. George E. Tyson has been appointed manager.

The Chicago-Jefferson Fuse & Electric Co. with general offices at 1500 S. Laflin St., Chicago, has changed its name to the Jefferson Electric Co.

The Curtiss-Reid Aircraft Co. will erect a new factory at Cartierville, Quebec, at a cost of approximately $153,000. The plant will have a capacity production of one plane per day.

Gears & Forgings, Inc., Cleveland, Ohio, has established a branch office in Milwaukee at 419 Commerce Building with Robert K. Plummer in charge as district sales representative.

The Erie Foundry Co., Erie Pa., has bought from the Beaudry Co., Inc., Boston, its line of motor-driven air hammers, in which the air compressor and motor are integral with the hammer.

The Lincoln Aircraft Corporation of Lincoln, Neb., has taken over from the Wright Aeronautical Corporation of Paterson, N. J., the exclusive manufac-

turing and sales rights in the United States and Canada for the Wright Morehouse light airplane engine.

The Carborundum Co. of Niagara Falls, N. Y., has opened the New Carborundum Building at 2759 E. Grand Boulevard, Detroit.

The S. & S. Die Casting Co., Providence, R. I., has purchased the plant formerly owned by the William H. Hamblyn Co., Cranston, R. I., and will equip it for manufacturing.

Personals

JAMES S. WATSON is now vice-president of the Link-Belt Co., as was announced last week in these pages. His headquarters are at the company's Dodge Works in Indianapolis, Ind. Mr. Watson was born in Philadelphia, and has been with the company continuously for 34 years, having taken his first job with the Philadelphia plant. In

January, 1903, after eight years' experience in various departments, he was put in charge of the exploitation of Link-Belt silent chain as a power transmitting medium. For the past nine years, Mr. Watson has been located at the Dodge Works, of which he was general manager in full charge of production of Link-Belt silent and roller chain drives, and from which point he also continues to be responsible for the selling of these drives as well as herringbone speed reducers.

LEWIS H. BROWN, 35 years old and a former salesman, was recently elected president of the Johns-Manville Corporation, $150,000,000 asbestos concern. He succeeds Theodore F. Merseles, who died on March 6 and whose assistant he had been since the latter assumed the presidency of the company in August, 1927. He is one of the youngest industrial executives in the country.

The directors also elected WILLIAM R. SEIGLE, formerly vice-president in charge of mines and factories, to the chairmanship of the board, which H. E. Manville vacated at his own request. Mr. Manville was made chairman of the executive committee. S. A. WILLIAMS was elected vice-president in charge of factories and mines.

B. F. BAKER, treasurer of the Kewanee Boiler Co., Kewanee, Ill., since the company was organized in 1892, was advanced to the presidency of the corporation at the annual meeting at the American Radiator Co., New York City. The Kewanee company was acquired recently by American Radiator. Mr. Baker will also be treasurer of the company, and is a director. M. F. MOORE was re-elected vice-president in charge of production.

E. E. BOONE has been appointed gearing apparatus sales manager of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., in place of J. E. Mullen, resigned. Mr. Boone will be located at the Nuttall Works of the Westinghouse company.

T. D. LYNCH, consulting engineer of the Westinghouse Electric & Manufacturing Co., has been nominated for the presidency of the American Society for Testing Materials.

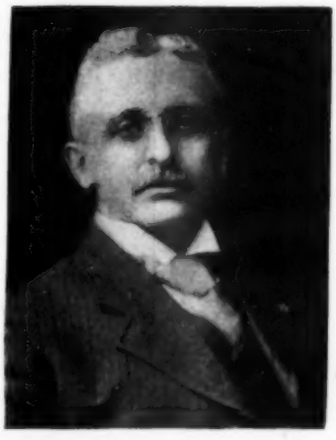
LAMAR S. PEREGOY, vice-president and secretary of the Sivyer Steel Casting Co., Milwaukee, has been named general manager.

E. R. LEEDER, formerly assistant to the manager, has been appointed factory manager of the Fisher Body Corporation, Lansing, Michigan.

FRANK BEMENT and RICHARD J. LE BLOND have retired as directors of the Niles-Bement-Pond Company.

Obituaries

CLARENCE J. WETSEL, formerly treasurer of the Springfield Grinding Co. and formerly secretary of the Van Norman Machine Tool Co., Springfield, Mass., died on March 18 in his 67th year at his home in Chicopee, Mass. In recent years he was in the bond business in Springfield. He was known chiefly as an expert accountant.



He started his business career as money clerk for the American Express Co. and stayed in the railroad line for some years, rising successively to secretary to a railroad president and then to railroad paymaster. He later became cashier and office manager of A. G. Spalding & Bros., and treasurer and general manager of the Bausch Machine Tool Co. In his rather varied career he was also treasurer of the Stone Meal Products Co. at the same time he was serving Van Norman interests.

WILLIAM H. VOGEL, president of the Wisconsin Machinery & Mfg. Co., of Milwaukee, died in that city on March 10 in his eighty-fourth year. In late years he was active as a director of the company in an advisory capacity only.

JOHN HOWARD ABEEL, vice-president of the Dexter Folder Co., died recently at his home in New York City at the age of 82.

Forthcoming Meetings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Regional meeting in Knoxville, Tenn., March 21-22. Eastern spring meeting in Rochester, N. Y., week of May 13. Third national meeting of the aeronautic division, St. Louis, Mo., May 27-30. Semi-annual meeting, Salt Lake City, Utah, July 1-4. Calvin W. Rice, secretary, 29 West 39th St., New York City.

NATIONAL METAL TRADES ASSOCIATION. Convention, Hotel Drake, Chicago, April 24-25. J. E. Nyhan, national secretary, Peoples Gas Building, Chicago, Ill.

AMERICAN WELDING SOCIETY. Annual meeting, April 24-26, at the Engineering Societies Bldg., New York. M. M. Kelly, secretary, 29 West 39th St., New York.

AMERICAN MANAGEMENT ASSOCIATION. Annual meeting, Hotel Pennsylvania, New York, May 7. W. J. Donald, managing director, 20 Vesey St., New York.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION. Thirteenth annual meeting to be held in the Hotel Statler, Cleveland, Ohio, May 16-18. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland.

NATIONAL ASSOCIATION OF PURCHASING AGENTS. Annual convention, Hotel Statler, Buffalo, N. Y., June 3-6. B. W. Hall, assistant secretary, 11 Park Place, New York, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, Saranac Inn, Upper Saranac Lake, N. Y., June 25-28. Coker F. Clarkson, manager, 29 E. 39th St., New York.

MACHINE TOOL BUILDERS EXPOSITION. Under the auspices of the National Machine Tool Builders Association, Sept. 30 to Oct. 4, in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, 826 Provident Bank Bldg., Cincinnati.

The Weekly Price Guide

Rise and Fall of the Market

THERE is still a shortage of semi-finished steel, with consequent upward pressure on prices of finished material. A scarcity of pig iron may develop shortly if the present high production rate of steel continues. The fact that scrap iron and steel are plentiful with prices steady, may serve to offset a possible shortage of pig iron. Finished steel prices remain firm and unchanged, with demand particularly heavy in plates and structurals. In non-ferrous metals, tin and antimony are lower this week, while copper is up 1c. per lb. at New York. The rising trend of copper has drawn with it fabricated brass and copper products, also scrap metal.

(All prices as of March 15, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$19.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	25.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	16.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	22.26
PITTSBURGH, including freight charge ($1.75) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.35	3.25	3.90*
No. 12	2.15@2.25	3.40	3.30	3.95*
No. 14	2.25@2.35	3.45	3.35	4.00*
No. 16	2.35@2.45	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.65@2.75	3.60	3.40	3.80
No. 22	2.80@2.90	3.75	3.55	3.95
No. 24	2.85@2.95	3.80	3.60	4.00
No. 26	2.95@3.05	3.90	3.70	4.10
No. 28	3.10@3.20	4.50	3.85	4.25
Galvanized				
No. 10	2.80@2.90	3.95	3.75	4.05
Nos. 12 to 14	2.90@3.00	4.05	3.85	4.15
No. 16	3.00@3.10	4.15	3.95	4.25
No. 18	3.15@3.25	4.30	4.10	4.40
No. 20	3.30@3.40	4.45	4.30	4.55
No. 22	3.35@3.45	4.50	4.35	4.60
No. 24	3.60@3.70	4.65	4.45	4.75
No. 16	3.75@3.85	4.90	4.70	5.00
No. 28	4.00@4.10	5.15	4.95	5.25

*Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness—Decimal Fractions	B.w.g. and	Outside Diameter in Inches ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .425"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire, New York, $\frac{3}{32}$, 8.35c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{2}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			20.25
Tin, Straits, pigs, New York			51.75
Lead, pigs, E. St. Louis	7.15	New York	8.37½
Zinc, slabs, E. St. Louis	6.35	New York	8.00

	New York	Cleveland	Chicago
Antimony, slabs	12.50	12.50@13.50	14.25
Copper sheets, base	29.12½	29.12½	28.62½
Copper wire, base	24.87½	21.00	22.87½*
Copper bars, base	27.62½	27.62½	27.12½
Copper tubing, base	30.12½	30.12½	29.75
Brass sheets, high, base	23.75	23.75	23.37½
Brass tubing, high, base	28.62½	28.62½	28.25
Brass rods, high, base	21.50	21.50	21.12½
Brass wire, high, base	24.25	24.50	23.87½

*At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%	25.00*	24.30	24.30
Zinc sheets (casks)	10.00@10.50	11.70	10.11
Solder (½ and ½)	34.75	34.00	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade			69.00
Commercial genuine, intermediate grade			53.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			12.25

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold rolled	53.00	40.00†
Tubing	75.00*	90.00
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper	17.25 @17.50	15.25	15.75 @16.25
Copper, heavy, and wire	16.25 @17.25	14.75	15.12½@15.50
Copper, light, and bottoms	14.75 @15.25	12.50	13.75 @14.25
Heavy lead	6.12½@ 6.37½	6.25	5.25 @ 5.75
Tea lead	4.62½@ 5.12½	4.25	4.25 @ 4.75
Brass, heavy, yellow	10.00 @10.50	10.00	9.75 @10.25
Brass, heavy, red		12.75	13.00 @13.50
Brass, light	8.25 @ 8.75	8.25	8.75 @ 9.25
No. 1 yellow rod turnings	10.75 @11.25	10.50	10.75 @11.25
Zinc	3.25 @ 3.75	3.25	3.00 @ 3.50

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†	.16	38.00 per M	.16
Sal soda, per lb	.02	.02	.02
Roll sulphur, per lb	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb	.11	.11	.114
Cutting oil, about 25% lard, in 5 gal. cans, per gal	.55	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal	.33	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	35%
Med. grade, heavy wgt.	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade	50%	50–10%	50%
Second grade	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0325	$0.0325	$0.0324
Cold drawn shafting	per lb.	.035	.035	.034
Brass rods	per lb.	.215	.2025	.165
Solder (½ and ½)	per lb.	.3475	.345	.3325
Cotton waste, white	per lb.	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia	per 100.	3.59	3.59	3.10
Lard cutting oil	per gal.	.55	.65	.65
Machine oil	per gal.	.33	.30	.27
Belting, leather, medium	off list.	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs	off list.	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper	$4.05	$4.29	$4.29
Emery cloth	20.22	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper	2.04	2.04	2.04
Cloth	3.59	3.59	3.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville, 2.75@2.85		
Coke, prompt foundry, per net ton	Connellsville, 3.75@4.50		
White lead, dry or in oil	100 lb. kegs	New York, 13.50	
Red lead, dry	100 lb. kegs	New York, 13.50	
Red lead, in oil	100 lb. kegs	New York, 15.00	

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	60%
Larger, up to 1 x 30-in., full kegs, list less	50–10%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	60%
Larger, list less	50–10%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.50
Structural, round head, broken kegs, net	6.00
Tank, 7–16-in. dia. and smaller, list less	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	60%
Larger, up to 3-in., list less	40–10%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$4.00
Wrought, broken kegs, per 100 lb., list less	2.00
Turnbuckles:	
With stub ends, list less	20%
Without stub ends, list less	50%
Chain:	
Proof coil, base, per 100 lb., net	$7.10
Cast iron welding flux, per lb., net	.40
Brazing flux, per lb., net	.80

Machine Requirements and Industrial Construction

Equipment Wanted

Ala., Birmingham — James P. Dovel, American-Traders Bldg.—two 5 x 5 in. opposed reversible reciprocating air engines; two complete chain drives with wheels; two speed reducers with cases; four tractor sprocket wheels; fifty-eight tractor treads each 10 in. wide, 6½ in. pin centers (in 2 chains); two axles; eight ball roller bearings; wood patterns for foundry molding and other equipment.

Ill., Chicago — Hudson Metal Products Co., 4500 Augusta Blvd.—machinery and equipment for the manufacture of screw machine products for addition to plant now under construction. Estimated cost $30,000.

Md., Baltimore—Berliner-Joyce Aircraft Corp., Hearst Tower — machinery and equipment for proposed aircraft factory at Baltimore Airport. Estimated cost $250,000.

Md., Baltimore—James E. Gunter Corp., Calvert Bldg. — machinery and equipment for the manufacture of a patented easy opening tin can for recently acquired plant.

Mich., Detroit—Enterprise Machine Parts Corp., 2731 Jerome Ave.—grinder and equipment for general machine work.

Mich., Detroit—Michigan Machine Co., 2281 West Fort St.—grinding machine and equipment.

Mich., Muskegon—Shaw-Walker Co.—sheet metal working equipment for proposed 5 story, 80 x 250 ft. desk factory on Washington Ave. Estimated cost $150,000.

Mo., St. Louis—Lyon Sheet Metal Works, 3123 South Broadway—10 or 12 gage metal forming rolls open end.

N. J., Paterson—Bd. of Education, City Hall—machinery and equipment for machine shop also pattern making and textile dyeing departments. Estimated cost $40,000.

O., Cleveland—Wellman Bronze Co., 6017 Superior Ave.—wood band saw, wheel diameter 24 to 30 in., wood turning speed lathe and iron surface plate, 30 x 36 to 36 x 60 in.

O., Shaker Heights (Br. Cleveland)—Bd. of Education, J. W. Main, Clk., South Woodland and Woodbury Rds.—equipment for manual training department and shops for proposed 3 story junior high school. Estimated cost $1,000,000.

Opportunities for Future Business

Ala., Mobile—Todd Shipyard Corp. Inc., 25 Broadway, New York, N. Y., awarded contract for extensions and improvements to plant here. Estimated cost $250,000.

Calif., Stockton—Fraser Gas Furnace Co., 445 South San Joaquin St., is receiving bids for a 1 story factory on Fremont St. Estimated cost $40,000. R. P. Morrell, Union Bldg., Archt. Noted Feb. 21.

Conn., Hartford—L. & H. Motor Co., T. W. Campbell, Pres., plans the construction of a 3 story plant at Broad, Flower and Howard Sts. Estimated cost $350,000. Architect not selected.

Ill., Chicago—International Harvester Co., 606 South Michigan Ave., awarded contract for a 5 story factory at Blue Island and Oakley Ave. Estimated cost $15,000.

Ill., Kewanee — Kewanee Mfg. Co., 401 Fremont St., plans the construction of a 1 story steel products plant at Division St. and Burlington Ave. Estimated cost $50,000. F. D. Chase Inc., 720 North Michigan Ave., Chicago, Ill., Archt.

Ind., Alexandria — Aladdin Industries Inc., had plans prepared for a 1 story machine shop. N. M. Dunning, 25 East Jackson Blvd., Archt.

Ind., Fort Wayne — Steinite Radio Co. awarded contract for a 4 story, 202 x 500 ft. factory including machine shop, etc. Estimated cost $400,000. Noted Feb. 14.

Ind., Indianapolis—Pierre & Wright, 1133 Hume Mauser, Archts., are having plans prepared for the construction of a machine shop and service station at 24th and Meridian Sts. Estimated cost $50,000. Owner not announced.

Kentucky and West Virginia — Chesapeake & Ohio Ry. Co., Richmond, Va., awarded contract for freight car shops at Russell, Ky., also locomotive repair shops at Huntington, W. Va. Estimated cost $3,152,000 and $3,493,400 respectively.

Md., Baltimore—G. L. Martin Co., airplane manufacturers, is having plans prepared for the construction of a factory. Estimated cost $300,000. P. L. Small & Associates, Terminal Tower, Archts.

Mass., Attleboro — General Plate Co., Forest St., awarded contract for a 1 story, 50 x 70 and 40 x 50 ft. additions to factory. Estimated cost $40,000.

Mass., Boston—Truscon Steel Co., 1517 Albert St. Extension, Youngstown, O., plans the construction of a fabricating plant here. Architect not selected.

Mass., Lynn—North Shore Cutting & Die Co., 266 Broad St., will build a 1 story factory on Broad St. Noted Feb. 21.

Mass., West Roxbury (Boston P. O.)—L. Moody, 29 Gould St., awarded contract for a 1 story, 50 x 100 ft. machine shop on Willow St.

Miss., Greenville — Greenville Insulating Board Corp., c/o Chicago Mill & Lumber Corp., 111 West Washington St., Chicago, Ill., has work under way on the construction of first unit of wood pulp mill here.

N. H., Laconia—Scott & Williams Inc., 299 Union Ave., manufacturers of knitting machinery, awarded contract for a 4 story, 65 x 180 ft. factory. Estimated cost $150,000. Noted Feb. 28.

N. J., Maplewood—Kroydon Co., Burnett Ave., is having revised plans prepared for a 1 story, 30 x 150 ft. factory for the manufacture of golf clubs. Estimated cost $40,000. D. A. Hopper, 22 Ridgewood Ave., Irvington, Archt. Noted Jan. 3.

N. J., Secaucus—New York Air Terminal Inc., W. F. Carey, Pres., 44 Wall St., New York, N. Y., plans the construction of an airport including hangars, machine shops, garages, etc. Estimated cost $8,000,000.

N. J., Trenton — State Institutions & Agencies plans a 2 story, 85 x 223 ft. industrial shop, etc. Estimated cost $325,000.

N. Y., Brooklyn — Dept. of Mental Hygiene, Albany, will soon award contract for the construction of a shop, etc., at Brooklyn State Hospital here. Noted Jan. 31.

N. Y., Flushing—S. Korcuberg, 65 Court St., Brooklyn, plans the construction of a 1 story, 200 x 250 ft. factory at Woodward and Flushing Aves. Estimated cost $150,000. M. Klein, 65 Court St., Archt. Flexible Cable Co., c/o architect, lessee.

N. Y., Lockport—Harrison Radiator Co., awarded contract for the construction of a 3 story factory. Estimated cost $150,000.

N. Y., Montauk—International Airports Corp., 25 Broadway, New York, plans the construction of an airport including hangars, shops, etc. at Nepeatue. Estimated cost $7,000,000.

N. Y., New York—Kay White Products Co., D. Kalzenstein, Pres., 8 West Broadway, plans a 2 story, 62 x 100 ft. factory at 156th and Barry Sts. J. Orlando, 645 East Tremont Ave., Archt.

O., Canton—Timken Roller Bearing Co., 312 3rd St. N. W., awarded contract for a 320 x 450 ft. tube mill. Estimated cost $1,000,000.

O., Cleveland—Cleveland Cap Screw Co., J. Fribley, Pres. and Gen. Mgr., 2921 East 79th St., is receiving bids for a 1 story addition to factory. Estimated cost $65,000.

O., Cleveland — Cleveland, Cincinnati, Chicago & St. Louis Ry. Co., 230 East 9th St., Cincinnati, awarded contract for a 1 and 2 story addition to round house, garage, etc., at Linndale yards. Estimated cost $450,000. Noted Mar. 7.

O., Cleveland—Thompson Products Co., C. E. Thompson, Pres., 2196 Clarkwood Rd., is receiving bids for a 4 story, 72 x 106 ft. addition to factory at 2196 Clarkwood Rd. Estimated cost $150,000. Roberts-Wright Co., Swetland Bldg., Archt.

O., Elmwood (br. Cleveland)—Highland Body Mfg. Co., Elmwood Pl., Cincinnati, manufacturers of automobile bodies, awarded contract for a 1 story, 71 x 126 ft. addition to shop here. Estimated cost $60,000.

Pa., Erie — National Foundry Co. will build a 1 story, 145 x 340 ft. machine shop on 17th St. Estimated cost $60,000. Private plans.

Pa., Erie — Standard Stoker Co. will build a 1 story, 75 x 122, 72 x 100 and 68 x 96 ft. addition to factory at Gaskell and Whitley Ave. Estimated cost $40,000.

Pa., Lansdale—Franklin Battery Co. will soon award contract for a 2 story, 86 x 500 and 68 x 120 ft. addition to factory. Franklin & Conver, Archts.

Pa., Philadelphia—Precision Grinding Wheel Co., 8300 Torresdale St., awarded contract for a 2 story, 70 x 96 ft. factory.

Tex., El Paso—American Smelting & Refining Co., Equitable Bldg., New York, N. Y., plans extensions and improvements to smelting plant here. Estimated cost $200,000. Owner will build. B. N. Rickard, El Paso, Mgr.

Tex., Houston—Burkhead Mfg. Co., 1920 Harrington Pl., manufacturers of sheet metal products, awarded contract for a 1 story, 85 x 200 ft. addition to plant. Estimated cost $30,000.

Va., Richmond — Richmond Car Works plans the construction of a plant near here to double capacity. Estimated cost $500,000.

Wash., Seattle—Union Battery Co., 2717 South Troy Ave., has acquired the R. J. Gorman Co., Inc., plant, and plans extensions and improvements to double the capacity, here.

B. C., Port Moody—Alberta Wood Preserving Co., Calgary, Alta, plans the construction of a creosoting plant on Barrard Inlet near here. Estimated cost $500,000.

Ont., Galt — Babcock-Wilcox & Goldie McCulloch Ltd., 64 Grand Ave. S., plans a 2 story addition to boiler machinery manufacturing plant. Estimated cost $100,000.

Ont., Ford—Merlo, Merlo & Ray, Sandwich St., is receiving bids for the construction of a 2 story garage. Estimated cost $80,000. Pennington & Boyd, Security Bldg., Windsor, Archts.

Ont., Leaside—Shipway Iron Co. Ltd., 700 Wellington St. W., Toronto, awarded contract for a 1 story ornamental iron plant here. Estimated cost $75,000.

Ont., Toronto — Ferrante Electric Ltd., 26 Noble St., plans the construction of a factory for the manufacture of transformers and electrical apparatus. Estimated cost $60,000 to $100,000. Engineer not selected.

Ont., Toronto — Consolidated Mining & Smelting Co., Canadian Pacific Bldg., and Ventures Ltd. ,Excelsior Life Bldg., plan the construction of a second copper refinery and zinc products works in Eastern Canada. Estimated cost approximately $25,000.

Ont., Toronto—Canadian Elevator Co., 24 Sherbourne St., plans the construction of a 2 or 3 story factory at Eastern Ave. and Heward St. Estimated cost $125,000. Ross & MacDonald, 1 Belmont St., Montreal, Que., Archts.

Ont., Toronto—L. A. Delaplatte, 1000 Gerrard St. E., is having plans prepared for a 6 story garage on Queen St. E. Estimated cost $300,000. W. R. Mead, Kent Bldg., Archt.